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Report 2 is a guide to commercially available instruments and equipment which can be used to automate measurements of structural behavior and environmental conditions at US Army Corps of Engineers' hydraulic structures. It also presents suggested methods to replace or retrofit existing instruments at Corps structures. Report 1 presented instrumentation automation techniques. Because of the many options which exist in selecting the appropriate hardware, the procedures in Report 1 for determining system requirements should be followed closely. Also, available software listed in Report 3 will influence system selection.

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The following two letters used as part of the number designating technical reports of research published under the Repair, Evaluation, Maintenance, and Rehabilitation (REMR) Research Program identify the problem area under which the report was prepared:

	Problem Area			Problem Area
CS	Concrete and Steel Structures		EM	Electrical and Mechanical
GT	Geotechnical		EI	Environmental Impacts
HY	Hydraulics		OM	Operations Management
CO	Coastal			

For example, Technical Report REMR-CS-5 is the fifth report published under the Concrete and Steel Structures problem area.

COVER PHOTOS:

TOP — Typical cutout at a plumbline location where an automated monitoring system has been installed. The sensor used with the automated system is hidden from view, except for the bottom, since it is installed up in the plumbline well.

BOTTOM — Software for use in data collection and reduction.

PREFACE

This is Report 3 of a series entitled "Instrumentation Automation for Concrete Structures." The report is a guide to available software packages for data acquisition and reduction instruments used at large concrete hydraulic structures. Methods of determining the requirements for and the subsequent design, assembly or fabrication, installation, checkout, operation, and maintenance of data acquisition and data reduction systems for use at or in large concrete structures are described in Report 1 of this series, "Instrumentation Automation Techniques." The commercially available instruments and equipment which will automate measurements of structural behavior and environmental conditions are described in Report 2, "Automation Hardware and Retrofitting Techniques," along with the suggested methods to replace or retrofit existing instruments at US Army Corps of Engineers structures.

The information in this report was compiled by Wyle Laboratories under contract to the US Army Engineer Waterways Experiment Station (WES). A panel of electrical and electronic engineers of Wyle Laboratories' Scientific Services and Systems Group authored the report. The contract was monitored by the Concrete Technology Division (CTD) of the Structures Laboratory (SL), WES. Wyle was assisted by Mr. Edward F. O'Neil, Evaluation and Monitoring Unit, CTD, regarding the various technical aspects in report preparation. Project manager for Wyle Laboratories was Mr. Aubrey C. Keeter.

Publication of the report was funded under Civil Works Research Work Unit 32309, "Improved Instrumentation for Older Structures," for which Mr. O'Neil is principal investigator. This work unit is part of the Concrete and Steel Structures Problem Area of the Repair, Evaluation, Maintenance, and Rehabilition (REMR) Research Program sponsored by Headquarters, US Army Corps of Engineers (HQUSACE). The Overview Committee of HQUSACE for the REMR Research Program consists of Mr. James E. Crews (Chairman), Mr. Bruce L. McCartney, and Dr. Tony C. Liu. Technical Monitor for this study was Dr. Liu.

The investigation was performed under the general supervision of Mr. Bryant Mather, Chief, SL, and Mr. John M. Scanlon, Chief, CTD, and under the direct supervision of Mr. Henry T. Thornton, Jr., Chief, Evaluation and Monitoring Unit, CTD. Problem Area Leader for Concrete and Steel Structures is Mr. James E. McDonald, CTD. Program Manager for REMR is Mr. William F. McCleese, CTD.

COL Dwayne G. Lee, CE, is Commander and Director of WES. Dr. Robert W. Whalin is Technical Director.

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CONTENTS (continued)

INSTRUMENTATION AUTOMATION FOR

CONCRETE STRUCTURES

AVAILABLE DATA COLLECTION AND REDUCTION SOFTWARE

PART I: INTRODUCTION

I-1-1.   This report is the third of a three-part publication, Instrumentation Automation for Concrete Structures, issued by the U.S. Army Corps of Engineers. It is intended to be used as a guide by individuals and organizations in the Corps of Engineers who are engaged in design, configuration, implementation, and retrofitting of automated data collection systems for concrete structures. The three reports are:

Report 1 - Instrumentation Automation Techniques
This report provides a guideline for establishing the requirements for automating the data acquisition instrumentation associated with concrete structures. The report generically describes the procedures and methods required to design, install, and maintain fully automated data acquisition and reduction systems. The methods and equipment referenced in this report are described in detail in Report 2.

Report 2 - Automation Hardware and Retrofitting Techniques
This report provides a description of commercially available sensors, instruments, and ADP equipment that may be selected to fully automate measurements of structural behavior and environmental conditions. Methods to retrofit or replace instruments that are already installed at Corps of Engineers structures are included in this report. Due to the many options which exist in selecting the appropriate hardware, the procedures for determining system requirements should be followed closely in Report 1. Also, available software listed in Report 3 will influence system selection.

Report 3 - Available Data Collection and Reduction Software
This report serves as a guide in selecting software for equipment that is described in Report 2 and identifies commercially available software packages that are applicable to data acquisition and reduction instruments which may be used by the Corps of Engineers.

I-1-2. Part I of this report is an introduction. Part II is a technical overview of the role of software in the computer system. Part III is the general criteria for selecting software. Part IV describes the general features of software packages listed in this report. Part V is a listing of available software appropriate to the needs of Corps instrumentation personnel, keeping in mind that hardware and software must be selected from a system perspective. All the software entries listed in Part V include information on compatible software and hardware. Part VI sorts the listings in Part V by computer system and application. Parts VII and VIII sort the listings in Part V by product name and by producer respectively.

I-1-3. This report is directed to minicomputer- or microcomputer-based data acquisition systems which are usable in a stand-alone computer mode. Many other data loggers and self-contained systems contain imbedded computers and software. These systems do not provide a means to alter the programs or operating sequences, and therefore, are not covered in this report.

Selecting Data Acquisition System

Choice of system

II-1-1. Selecting a data acquisition system appropriate to the needs of a particular facility usually resolves itself into a decision between a computer system with the necessary peripherals and software or a self-contained data logger. A data logger is an instrument which is designed for the purpose of acquiring and displaying information from sensors in an easy-to-use, but well-defined manner. They are usually based on microcomputers and contain the required programs permanently stored internally. A data logger is the correct choice when the requirements are simple, well-defined, and are within the limits of the unit under consideration. This report is intended to cover only computer systems which offer more flexibility and versatility, but usually require a greater level of expertise to correctly select, assemble, and program. Only those computers for which the operational software may be selected and installed to suit the needs of the user are included.

Performance limitations

II-1-2. The performance limitations of the computer-based data acquisition system are established by the configuration of the hardware. The degree to which maximum system performance is achieved is determined by execution of the proper computer program or software. Therefore, it is critical that the selection of all hardware and software be done from a total system perspective.

Hardware/software compatibility

II-1-3. Compatibility between hardware and software is essential to the operation of the system. It is also important in anticipation of expanding the system. This compatibility must

exist between the central processing unit (CPU) supporting a fixed machine language instruction set, and the several tiers of software built upon it.

Levels of software

II-1-4.   The software in a computer system consists of several levels or layers of programs which support everything from operator interface needs to basic hardware control requirements (Figure 1).   The binary machine instructions processed by the central processing unit (CPU) are far removed from the numbered lines in a BASIC program entered by a programmer.   For instance, in order to switch input channels, several levels of the software hierarchy are involved.   All data, instructions, and control are processed by the CPU, which is the base of the computer system.


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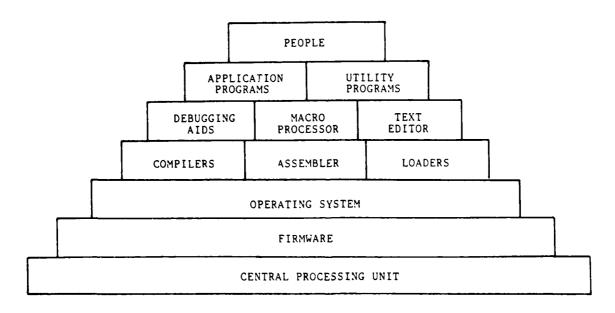
FIGURE 1.   COMPUTER SYSTEM LEVELS

Immediately above the CPU, in the software hierarchy, are the programs that provide for system powerup (BOOT), basic input/output software (BIOS), and communications (MONITOR) between the CPU and the upper levels of the hierarchy.   These

machine-specific programs are normally contained in a read-only memory (ROM), often called firmware. The programs contained in the ROM remain in the computer, whether power is on or off. In a disk-based system, one of the monitor functions is to load the operating system (OS), which is the next higher level in the software hierarchy, into the computer from the disk.

Operating system

II-1-5. The OS provides all user access into the system in a convenient and orderly manner. It directs the access of computer hardware elements by languages, application software, and system support software. Disk- and tape-based systems load the OS into the random access memory (RAM) where it resides throughout execution of most programs. The OS manages the computer hardware resources and provides file management, allowing the user/application program to access data or other programs located elsewhere in the system. It also loads and controls the execution of programs, allocating RAM memory space so that the CPU may begin execution. Multitasking operating systems are able to run several tasks or programs at the same time. This is useful for instance when one program is outputting data to a printer or plotter while another program is simultaneously acquiring data. Support software known as a utility package is included with the OS.

Utility programs

II-1-6. Utility programs, "utilities", fall under the heading of system support software. These programs support the rudimentary requirements of a computer system such as disk formatting and backup, file copying, system generation, file interrogation, and hardware test routines (diagnostics). Diagnostics are programs to exercise the hardware, and detect and locate malfunctions in the system.

Languages

II-1-7. The software used on the systems previously described is stored as a binary (object) code format compatible with the specific computer on which it operates. This is code which may be run or "executed" by the system without further processing. This "machine language" is difficult to decipher, but allows the system to operate at maximum speed and efficiency. The object code may be generated by a low-level language, i.e., assembly code where each action of the hardware, such as moving a piece of data from one location to another, results from a single instruction line. This code which is "assembled" into an executable program by the Assembler program is efficient, but difficult to write and very difficult for another programmer to read and understand without extensive comments and documentation. Higher level languages such as FORTRAN, BASIC, Pascal, etc., allow programmers to develop software in a more human-readable form. High-level languages may be either compiled, where the English-like source program is run through a "compiler" program to produce an executable object program, or interpreted, where each line is converted to appropriate machine instructions as it runs. FORTRAN and Pascal are examples of compiled programs, while BASIC is usually interpreted. Some interpreted languages can also be compiled for faster execution. Making a change to a BASIC program requires simply editing a line or group of lines and running. Changes to a compiled language are made in the source code which must then be recompiled before running.

Language support system

II-1-8. A language support system, consisting of an assembler, compiler, or interpreter, converts the human-readable statements (source code) into machine-readable (object code) formats. These languages are commonly used in writing programs for the highest tier in the software hierarchy, the applications programs. However, in order to protect the rights of the author,

purchased programs are often already converted to object code, eliminating the need for the language support system.

Applications

II-1-9.   Applications programs are often machine-independent software elements designed to perform specific tasks for the user, such as data manipulation or word processing. The application programs listed in PART VI of this guide are those designed for acquisition, processing, and display of data of the type and frequency anticipated in the monitoring and acquiring of data at or in dams or other large structures.

II-1-10.   Applications programs are available in several formats, as source or object code, and in different physical forms (media). These include tape, disk, or optical storage, and solid-state ROM memory chips which either plug into sockets in the computer or into connectors on the system. Programs may also be obtained electronically via a modem or as a listing which must be entered by an operator. Of course, care must be taken to ensure compatibility of the media with the system hardware (i.e., if the program is provided on a disk, a compatible disk drive is required).

II-1-11.   This software overview is included for the sake of completeness. The purchaser needs to be aware of the software system structure, but should not be overwhelmed by the details. The major concern is the capability of the applications programs, as constrained by the operating system and the size and speed of the computer used.

PART III: SOFTWARE SELECTION

Functional Requirements Definition

III-1-1.   The design or selection of software presents special problems not usually associated with the parallel design problem from the hardware viewpoint.   These problems are the result of the functions performed by software and the general misconceptions that anything can be accomplished in software with little impact on total cost.   These problems are best minimized by rigidly defining the goals of the software in terms of the functions and performance expected in each area. This must be done in conjunction with the hardware specification and selection.   Another important feature of any software design or selection is the definition of a minimum system which can accomplish the primary goals and objectives of the overall system being designed.   This rigid structuring and minimal system approach should not limit flexibility or future expansion, and should satisfy the initial goals of the system design. In this way, the probability of success with minimal resources expended is more realistic.

III-1-2.   Before any system design may commence, the system designer must decide exactly what are the functional requirements for the overall system and then analyze these requirements to determine which are to be met by the software. Any requirement, which cannot be specifically allocated to hardware or software, should be included in both.   At this point, the functional requirements should be evaluated as to their importance in meeting the overall system objectives.

III-1-3.   The starting point in the definition of software requirements is to list the functions to be performed, and then prioritize this list into three categories, as follows:

    a. Essential.

<u>b</u>. Important.

<u>c</u>. Desirable.

III-1-4.   At this point, the system designer can use the "essential" requirements to define a minimal system selection requirement.   This minimal system should be used as the basic statement or specification of the software to be selected. Appendix A defines the contents of the Requirements Document.

III-1-5.   Once   the   basic   statement   of   functional requirements is drafted, the ancillary requirements, i.e., those identified as "important" and "desirable", may be added to the appropriate sections with notes as to the relative importance and necessity of each.

III-1-6.   A   final   draft   of   the   software   functional requirements is now available for evaluation. At this point, the capabilities of the software under consideration should be compared with the Requirements Document. Any disparity between them must be resolved, either by changing the requirements or by modifying the software.

Major Selection Criteria

III-2-1.   The software considered must satisfy the
following basic requirements in order to be selected for use with
a system:

    <u>a</u>. Is it compatible with the system hardware?

    <u>b</u>. Is it compatible with the other system software?

    <u>c</u>. Does it satisfy the minimum system performance
       requirements as defined in the Requirements Document?

Hardware compatibility

III-2-2.   The software chosen must be compatible with the
hardware available, but it is often difficult to analyze all the
aspects of this compatibility. To operate properly, the software
in question may require a minimum memory size, particular display
types, printers or plotters, disk or tape storage units, or
specific interface units. A powerful, expensive program without
the peripheral devices needed to support its capabilities may be
more an inconvenience than can be tolerated. Often at selection
time, economic factors dictate compromises in hardware purchases.
Sometimes too, it is not apparent which options are required and
which are just conveniences.   For these reasons, both the
hardware and software must be adaptable to future requirements.

III-2-3. Consideration must be given to:

    <u>a</u>. <u>Media</u>-Are they available in a format which may load
       directly into the computer: It is important to
       remember that disks or tapes which fit in the computer
       drives may be formatted in a multitude of ways that are
       unreadable by the system. It is only if the software
       is designed to be installed on the system computer
       selected that there will be any assurance of proper
       operation. The physical characteristics of the media
       which must be considered include:

       <u>1</u>. Disks: 8", 5-1/4", or 3-1/2"; single- or double-
           sided; single, double, or quad density.

2. Tapes (1/2"): reel or cartridge; 800, 1600, or 6250 bits per inch (bpi); tape-small format (cassettes and cartridges).

3. ROMs: cartridge or plug-in chips, usually very machine-specific.

b. **Memory size**-Does the software run comfortably in the amount of memory available in the computer? Allowances must be made for data storage, data buffers, operating system and any other software likely to be present at the same time. If the memory use is close to the available maximum, it is important to determine the cost and practicality of increasing the memory size. If the system is subject to change or adaptation in the future, include plans for these factors at system definition time.

c. **Input/output (I/O)**-Programs for data acquisition must of necessity interact with the outside world through interfaces. Typical of these interfaces are the EIA RS-232-C, the IEEE-488, and general serial and parallel types. The hardware to support the type(s) of interface(s) called for in the software must be present for proper operation.

Software compatibility

III-2-4. The most important aspect of software compatibility is the necessity for the application software to function properly with the existing operating system. Since a computer may support any of several operating systems, and possibly several versions of each operating system, an assurance of proper operation is most important. For example, many programs run on both PC-DOS and MS-DOS operating systems. In fact, the two are alike, the former being supplied with IBM PCs and the latter with other compatible systems. The other area of concern is the compatibility of the program with any software which makes use of the acquired data. If this aspect is overlooked, further processing or conversion of data may be necessary before they may be used.

Performance requirements

III-2-5. The basis for creating a functional system is to select hardware and software that satisfy the essential requirements defined in the Requirements Document. For data acquisition software, channel capacity, accuracy, speed, display, and data handling are included. Selecting software, which is compatible with the hardware and other software and which meets the essential performance requirements, assures the designer of creating a viable product.

Other Selection Criteria

Language

III-3-1. The choice of language for an application program is of secondary importance to the user. Assuming that the program satisfies the performance requirements, then the user is only interested in the language for future maintenance or modification. In this case, it is well to opt for a language which is familiar to user personnel and easy to change, and avoid cryptic, obscure, and hard-to-understand languages such as C, APL, and ASSEMBLY. Modifications and changes to an interpreted language like BASIC are much quicker and easier.

Response time

III-3-2. In addition to the speed requirements which are a part of the system performance specifications, a further consideration in terms of user convenience is the response time of the software. This is an intangible attribute which encompasses the speed with which the software responds to user inputs, display updates, and operations such as program and data storage and retrieval. While this is not a critical concern, it contributes to operator satisfaction and efficiency; therefore, to system reliability.

Adaptability

III-3-3. Any software module is dependent upon four factors which allow the program to be adapted to changing requirements, as follows:

    a. Portability. Current trends in computer hardware design have seen life cycles of production systems severely shortened as bigger, faster, and cheaper systems continuously become available. In order to ensure that the software written today may run on future hardware, some degree of portability is desired. This means that the software is able to run on a family of hardware, rather than on a particular model.

b. **Size/speed growth.** The computer resources used by an application should allow sufficient margins in CPU and I/O bandwidth to permit the software to run faster and with more data if necessitated by changing requirements.

c. **Built-in flexibility.** Many acquisition and reduction packages allow for adaptation to the size and speed of the acquisition process. These packages usually provide a set-up phase which allows the user to adapt the configuration of the software to individual acquisition and reduction requirements. Another desirable feature often built into such packages is what is referred to as user "hooks." These "hooks" are built-in linkages which allow the user to either tie into a data structure or actually link user-developed software into the software, so that site-specific modifications may be accomplished without reworking the purchased software.

d. **Generic data structure.** It is highly critical that software (especially custom software) conform to existing standards for data representation, i.e., IEEE and ANSI type standards, and are designed in a modular manner so that individual functions may be modified without reworking an entire package. As an example: plotting packages are usually supplied with a set of I/O interface routines that fit specific plotting devices and a generic interface routine that may be customized for a specific application.

Hardware utilization

III-3-4. In order to gain the maximum utility from the system, it is important that the software take advantage of all the capabilities of the hardware. Examples of hardware capabilities include:

a. RANDOM or SEQUENTIAL order of channel selection. Random channel selection allows the user to set up a "scan table" with the sequence of channel sampling defined. This allows selected input to be skipped or selected more often than other channels. Sequential scanning assumes that the inputs to be converted are done in the order in which they are physically connected to the system. In this mode, the software should allow the user to select the first and last channel to be converted.

b. Calibration features controllable by the program.

c. One or more channels of real-time data display.

d. Gain control or autoranging.

There may be many other features which may be used under program control.

Data format

III-3-5.   In order for data to be accessed by other programs, they must be stored in a format which is decipherable by those programs. Several standard data formats such as ASCII, are not linked to any specific computer hardware. These formats are particularly appropriate for data which are to be sent serially from one computer or location to another. Unique or highly customized formats which include control characters or protocols that are not recognizable to other programs can cause great difficulty. A nonstandard data structure may require the creation of a translation program to prepare the data for use by display or data reduction software.

Calibration features

III-3-6.   Often hardware includes some sort of provision to provide calibration of the input channels.   This may include relays which remove and ground the input or connect it to a fixed, stable input. If the software supports this feature, it becomes feasible to include automatic calibrations at selected times during the data collection process.   This provides increased data integrity and often provides a warning of a hardware malfunction.

Gain programming

III-3-7. Selection of channel gain is done in several ways on different systems. Some hardware units have amplification factors that are unalterable, either on an overall or individual basis. More flexible systems allow the gain to be set either by switches or changing hardware components.   Finally, there are

systems that provide for the gain on individual channels to be set either automatically or under the control of the software. If the selected hardware supports these options and if programmable gain values are of use in the data acquisition system, then the chosen software should fully support these options.

Data security

III-3-8. Data acquisition is the first step in providing information which aids the engineer or scientist in the analysis of the condition of a structure. The data are, in many cases, priceless and irreplaceable. It is critical that the data be protected against loss or destruction. This may entail creating back-up copies automatically or collecting redundant data. The security that the software provides for the data is an important consideration in the software selection process. It is also necessary to isolate the casual user from access to data that may be susceptible to accidental erasure or overwriting.

Ease of use

III-3-9. The use of computer-based data acquisition systems is a new experience to many people. Therefore, it is very important to consider convenience of operation of the software. A system which is easy to use, such as a menu-based or prompted question type, allows an operator to become familiar with the system quickly. An operator who understands the capabilities of the system can extract maximum performance from the hardware and the software. Ease of use includes: unambiguous operator choices, clear instructions, failsafe operation, confirmation of critical choices, and simplicity.

Data reduction/analysis features

III-3-10. The data acquisition process provides the means by which data are collected and stored. The data so collected must, by their nature, be reduced (or concentrated) and analyzed

for meaningful engineering and management decisions. The tools that may be provided by software to facilitate the reduction and analysis of data may include, but are not necessarily limited to the following:

a. Conversion to engineering units.

b. Plotting and graphics.

c. Statistical and trend analysis.

d. Time series analysis.

e. Tabulation.

f. Database storage/access.

g. Demultiplexing.

h. Averaging.

i. Decision making.

Communications

III-3-11. The ability of a program to communicate with other user's programs or computers is a convenience and in some cases a necessity. This may simply involve transferring data files or even standardized graphic output for use on more capable systems. These features may be a significant item for consideration at selection time.

Plotting and graphics

III-3-12. The capabilities of plotting and graphics are usually hardware-dependent, but current state-of-the-art systems are available or are being developed to provide for device-independent access to these functions. The primary concerns of the system designer should be pointed toward the selection of plotting and graphics packages which have sufficient flexibility to cover the existing plots and graphs that are being prepared manually. Customer support and/or availability of user group support or in-house expertise should be considered as important prerequisites for any system chosen, since tailoring the specific site requirements is always a given necessity. Likewise, the

compatibility with the acquisition data storage, languages used, and any database software is very important to maintain.

Familiarity

III-3-13.   An important factor in selecting software is familiarity of the software to the user or other Corps of Engineer personnel.   Good and bad experiences, coupled with first-hand knowledge of the idiosyncrasies of a package, are all valuable factors in selection.   Learning from the experience of other users may save a great deal of effort and time in getting a system up and running.

Networking

III-3-14.   Many computer sites are becoming more dependent on data communications with other locations and with other computers at the site.   Interconnecting computers is known as networking.   This requires hardware to connect the computers (usually including coaxial cable and interface electronics), and network software (see paragraphs 147 through 151 in the report on Instrumentation Automation Techniques).   The network software enables the computer to send and receive files and data to and from other computers, storage devices or printers.   If networking is considered for the system, all other software should support concurrent operation of the network software.

Support

III-3-15.   Support is one of the most important selection criteria to be applied to any software to be purchased or developed, i.e., what alternatives are available to solve future problems and allow for modifications that may be necessary.   The areas of support which are of utmost importance to the selection of software are as follows:

   a.   Training.   Is a training course or sufficient tutorial documentation available to aid personnel, who will operate and interact with the software, in becoming

proficient in its use and features. The training may be in many forms, from a simple menu-driven operator-oriented program with minimal instructions to on-site formal training or equivalent video tapes, documentation and on-line help files to aid in transition from manual to automated procedures.

b. <u>User groups</u>. An important source of information and "free" advice may be obtained by actively participating in user groups. These groups generally exist for many widely used software packages and hardware operating systems.

c. <u>Vendor consultants</u>. Most reputable software houses offer, at least through some warranty period, availability of a user consultant to answer questions and solve problems. These services are also available after the warranty period on a service call basis or in the form of a maintenance agreement.

d. <u>Third party consulting</u>. Independent systems houses may provide assistance on a fee-paid basis.

e. <u>In-house support</u>. Personnel who have first-hand experience with the software can often answer minor questions and provide help in running the software.

f. <u>Source versus object code</u>. If the source code is available and provided with the software, problem solving at least becomes possible. A program which comes only as object (executable) code is nearly impossible to understand, maintain, or modify. Object code makes the user totally dependent upon the producer for those functions.

g. <u>Updates</u>. A reasonable, reliable method of obtaining updates to programs can provide assurance of trouble-free operation.

h. <u>Maintenance contracts</u>. In the case of large and complex programs, a maintenance contract may be considered. This guarantees that personnel familiar with the program will be available to provide assistance with any problems that arise.

<u>License agreements</u>

III-3-16. Software is usually not purchased, but rather a license to use it is obtained for the cost. This license may be in several forms. The most limited form of license is one which

permits the user to run the software on only one specific computer. The other agreements may provide site licenses, which allow unlimited use at a single facility. "Public domain" software is free for use and/or modification. The restrictions on use caused by licenses must be considered at the time a software selection decision is being made.

Copy protection

III-3-17. Careful consideration should be given to the capability of creating back-up copies of the software media. Programs which incorporate a data recording method that prevents making a copy of the program by normal system procedures are said to be "copy protected". The obvious problems of not being able to function normally because of damaged media, and the possibility of not being able to operate for an extended period until a replacement program arrives are evident. In addition, copy-protected software is often not amenable to modification or adaptation. Simple program changes to accommodate specific user requirements may not be possible. For these reasons, copy-protected software should be considered only if these limitations are acceptable, or if the particular program under consideration is the only way to fulfill the system software requirements.

Acceptance testing

III-3-18. Unfortunately not all programs work exactly as advertised, even those from reliable vendors. In order to protect the functionality of the system, it is necessary to devise an acceptance test which demonstrates to both user and producer that the software does in fact do the job. Reputable software sources are happy to have a well-defined set of standards in order to demonstrate the proper operation of their product, and eliminate questions and confusion later. The user should define and document a test set which assures that the end product is a usable system, and not an expensive collection of items that "almost" works.

PART IV: GENERAL FEATURES OF SOFTWARE PACKAGES LISTED IN THIS REPORT

Commercially Available Software Packages

IV-1-1. In order to appeal to the widest possible market, commercial software packages are written in an attempt to make them "user-friendly", flexible, and inexpensive. Being user-friendly means that the user has little trouble operating the programs in the package. Flexibility means that the user may conveniently modify the package to fit particular needs.

Menus and templates

IV-1-2. The easiest programs to use are either menu-driven, which display a list of available functions for the user to choose from, or those that provide templates, an incomplete table with blanks for the user to fill in with pertinent information. If the user has trouble understanding the choices, or filling in the blanks, the friendly program is equipped with a "HELP" function which guides the operator. HELP functions vary in actual helpfulness, but are designed to be accessed easily from anywhere in the program, and to provide detailed information on how to perform a function, as well as options available to the user. A "context-sensitive" HELP function, one which knows where the user is in the program, provides detailed information on the item with which the user is currently dealing. For example, if he is setting up channel gains and does not know the next step, a context-sensitive HELP request provides information about gain selection.

Function keys

IV-1-3. If a function is commonly used, the program might perform it merely by having the operator press a "function key" on the keyboard. The program may have predefined function keys,

or it may be flexible enough to allow the user to define the operations performed by the function keys. All of the features described above allow the program supplier to claim, "no computer skills required," by the operator. All the user must do is read the screen and press the appropriate buttons when prompted by menus, or fill in templates guided by HELP screens.

Flexibility

IV-1-4. The flexibility of a software package may be determined by its modularity. A package is comprised of several modules (sets of programs, or subroutines) which complement each other, but don't necessarily depend on each other to operate. This allows the user to "mix and match" modules to suit the application. Flexibility is increased greatly if the package provides a means for the user to append his own subroutines. This requires support for the language in which the subroutine is written, and the system for linking the pieces into one coherent program. Some packages go a step beyond by providing a "tool kit" for easy modification of the program.

Price

IV-1-5. The prices quoted in part V are derived from the vendors through brochures, catalogs, and telephone calls. They are subject to change, and are provided for relative comparison purposes. Many vendors provide discounts for GSA contracts and large quantity purchases.

Software Package Functions

IV-2-1. The software packages listed in part V fall into the following categories: Data Acquisition and Control, Data Analysis and Reduction, Graphics, Communications and Miscellaneous.

Data acquisition

IV-2-2. Data acquisition packages acquire data for the user in a manner specified at setup time. During setup, the user specifies the number of channels to be scanned, the type of signal inputs for each channel, calibration values, other data necessary for engineering unit conversion, and scan rate. Some packages allow the user to group channels and/or scan channels at variable rates and even to scan a channel at a rate varying with time.

IV-2-3. Once the data have been acquired, the package provides a means of presenting the data for immediate viewing by the user, and storage in data files for later use. (See Technical Report on Automation Techniques, paras. 168 - 170.) The data may be displayed on a CRT or printer, or saved on a disk, tape, or printed for permanent storage. Recording on a disk or tape eliminates the need to type the data again for use by another program. Output to a printer or CRT provides immediate viewing and the printer provides a permanent hardcopy. The CRT may display updated channel values as they are scanned providing a real-time display of channel values or a graphic display of measurement values.

IV-2-4. Another useful CRT terminal feature is multiwindow displays, a method for viewing several different segments of the program on the same CRT. Windows allow the user to monitor simultaneously the results of several functions provided by the system.

IV-2-5.   Signal filtering, usually provided by the hardware, may also be done in software through digital filtering and averaging routines.   This capability allows the user to control and separate the frequencies of interest in the data.

IV-2-6.   Alarm conditions are also specified at setup time. The user may set maximum and minimum allowable values, or limits on the rate of change of a value.   Some packages allow the user to disable alarms, or provide "deadbands", disabling only a portion of the possible alarm values.   The user may be required to acknowledge an out-of-limit condition, and a permanent record of alarm events and summaries of values attained may be provided. If the package has the capacity to control, the user may set up a series of actions to be initiated in case of alarm conditions.

Control

IV-2-7.   The ability to control is provided with many data acquisition packages through digital and analog hardware output options.   Because of the infrequency of some measurements of structural behavior phenomena of concrete structures, i.e., daily, weekly, or even less frequently, it is advantageous to keep the transducer power supplies in a STANDBY or OFF mode (sleep) until several moments before taking the readings (sleep/wake periods).   This requires a control output from the program to "wake" the gage to be read.   Another requirement for control output is to switch leads of a three-wire Carlson gage to compensate for resistances of long wires to the gage (Refer to Appendix B of the report "Automation Hardware and Retrofitting Techniques").   Analog outputs are used for "closed-loop" control which requires variable output voltages proportional to a measured input.   This type of output requires a digital-to-analog converter hardware option.   The variable voltage output has wide usage in controlling electrically adjustable valves or DC servomotors.

Data reduction, Analysis and Graphics

IV-2-8. The acquired, recorded, and filed data may be used later by more or less sophisticated data reduction, analysis, and graphics programs. Reduction programs should include all of the mathematical and statistical functions required by the user. Available functions may include:

a. Statistics

b. Trigonometric functions

c. Differentials

d. Fast Fourier Transforms (FFTs)

e. Vector, matrix handling

f. Polynomial operations

g. Eigenvectors and eigenvalues

h. Filtering

i. Data interpolation, smoothing

The reduced data may be reported to the user in tabular or graphic form. Graphs may include plots of real-time data versus time (trending) or historical data versus time.

IV-2-9. All of the software functions previously mentioned above may be combined to complete the user's requirements. Optimally, no operator reentry of data should be necessary, thus avoiding typographical errors and taking advantage of the speed of the computer. If it is necessary to interface several systems, communications packages may be necessary to transfer data.

Communications

IV-2-10. Communications may be either a part of other programs or a separate program. Usually a communication program is designed to send complete data or program files over a communication link, and to verify proper transmission by extensive error checking and comparing. Files formatted in a standard ASCII format are most commonly used.

Miscellaneous

IV-2-11.   The software included under the miscellaneous
category is any package that is related to the instrumentation
automation process but does not fall into the other categories.
These include data base programs that allow the selection and
grouping of data and word processing software which is helpful in
producing final reports of collected data.

Types of Packages Listed

System packages

IV-3-1. System packages provide both hardware and software for the user applications. This not only reduces the purchaser's concerns over compatibility, but also his choice of components. The system price is determined from the range of prices quoted by the final system configuration. Several system packages provide system security which limits access to the program to authorized personnel via a password. Also, the entire system, hardware and software, may be backed up by a redundant "failover" system, ensuring continuing operation even if some components fail.

Data acquisition (and control)

IV-3-2. Data acquisition (and control) packages do not include hardware components, but are designed for use with specific brands. The user is responsible for ensuring compatibility, but has more choice in the final system configuration. Many software packages accept any hardware with a standard interface (see "Instrumentation Automation Techniques" report , paras. 53 - 61), or vendors are willing to write a specific "device driver" for an incompatible instrument. The package price is fixed per module, but the user still has a choice of modules. The package may provide all reduction, analysis, and graphics functions needed, or may be designed to take advantage of another software package which provides these functions. In Table 1, all data acquisition packages contained in this report are listed, and features specifically indicated by their vendors are marked (o). If the package interfaces with another package having these features, it is indicated by (o).

Data reduction

IV-3-3.   Data reduction packages are available if the data acquisition package does not fulfill all of the user's requirements. The data files must be in a compatible format to

Table 1

Data Acquisition Package Features

Package	Menu Driven	Modular	No Operator Computer Skills Required	User May Modify Programs	On-line Modification of Variables	System Security	Run Other Programs Simultaneously	Diagnostics	Monitor	Record to CRT	Record to Disk	Record to Printer	Variable and/or Multiple Sampling Rates	Alarm High	Alarm Low	Alarm Rate of Change	Alarm Disable Capability	Alarm Summaries or Reports	Digital Output Capability	Real-Time Display	Thermocouple Inputs	File Management	On-line Calculations	Conversion to Engineering Units	Signal Filtering	Reduction Programs	Interface to Data Analysis Programs	Report in Tabular Form	Report in Graphic Form	Trending	Historical Data
ACT - II				●		●	●	●		●	●	●	●	●	●		●	●	●	●		●	●	●		●		●	●		
AIM	●			●			●	●										●	●	●		●	●				●			●	●
Enhanced ALERT	●			●	●		●	●		●	●	●		●	●		●		●	●		●	●				●		●	●	
ASYST			●			●		●	●	●										●						●			●		
CHIPS		●			●	●			●													●				●			●	●	
DADISP	●	●					●	●												●		●	●	●			●		●	●	
DAIS	●	●						●														●	●	●			●		●	●	
DARAD - 150									●										●			●		●						●	
DARAD - 200									●										●			●		●						●	
DDACS - 1000							●	●											●			●		●					○		
DT/Notebook	●		●	●		●				●	●	●									●	●	○				●		○		
Dynamik	●				●													●			●	●	●	●		●			○		
FactoryLink	●	●		●	●		●	●		●	●	●							●			●	●	●			●				
Factory - PAC 2	●	●																					●			●			●		
HP Data Acquisition Software	●											●						●				●		●			●		●		
IDBS - 8000	●	●		●	●			●		●	●		●				●	●	●			●		●		●		●	●	●	
IMPACT - I		●		●	●													●	●		●						●	●	●		
LABSOFT	●					●		●	●		●		●								●	○	○		○	○	●	○	○		
LabTech Notebook	●				●		●		●	●			●								●	○	○		○	○	●	●	○	○	○
Macquisition/Macontrol		●											●									○	○				●		○		
MAXS																						○	●								
microMast - mt	●							●														●		●			●	●			
MIDAS	●		●							●	●									●						●		○	○	○	
miniMast				●																							●				
NDAS - PC	●				●								●									●				●		○	○		
ONSPEC		●																				●					●				
PACE/32					●		●		●	●			●		●				●			●	●					●	●	●	
PC/DBS	●			●		●		●	●		●		●									●					●	●	●	●	
PRO	●							●	●													●							●		
Q.E.D. DAC	●		●		●			●	●				●									●		●				●	●	●	
RCS - 7	●	●	●	●	●	●		●	●	●	●	●										●	●				●	●	●	●	

allow access to the data. Data reduction programs may combine the results of one or more channels of data and eliminate unnecessary storage or processing. Often, the relevant data are only a tiny fraction of the total acquired.

Analysis

IV-3-4. Analysis packages increase the capabilities of a computer system by providing sophisticated mathematics and logic functions which may not be provided by the data acquisition package. The use of these specialized packages must be determined by the application's data reduction needs.

Graphics

IV-3-5. Graphics packages provide a wide variety of pictorial presentations of data from standard two-dimensional plots, log-log and semi-log plots, contour maps, histograms, bar and pie charts, and other charts.

Communications

IV-3-6. Communications packages provide a means of conveniently interacting with other micros or mainframe computers. They handle the chores of communicating with the other computers and determining if the data that is being transmitted is correct or if it contains errors, allowing the user to concentrate on more important items. The packages range from the bare necessities of communications to sophisticated software that allows user programmable functions to handle decision making options.

Data Acquisition and Control

V-1-1. **Product name and abstract:** ACT-II. This is an intrinsically safe process monitor and data management system with alarms and system security. The system has a multiwindow display, accepts virtually any type of analog input, and accommodates almost any configuration of analog multiplexers, CRTs, and printers.

    a. Application: Data acquisition.

    b. Company: Transmation, Inc.
                    977 Mt. Read Blvd
                    Rochester, NY 14606
                    (Phone) (716) 254-9000

    c. Pricing: Ranges from $25,000.00 to $150,000.00 depending on physical configuration, input types, and options selected.

    d. Hardware support: Intel 8086 16-bit processor family (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-16 through 19 and 4). Provided with system: 5-1/4-inch floppy disk drive, keyboard, dot matrix printer, analog MUX, digital MUX, central modem, 12-inch monochrome CRT or optional 19-inch color CRT. Optionally: redundant computer configuration, alarm contact output, intrinsically safe. One Mbyte memory capacity.

    e. Compatible instruments: Not specified.

    f. Features:

        1. Totally on-line system configuration.

        2. Acceptance of any analog or digital input, including all thermocouple types. From 200 to 2000 inputs may be connected.

        3. All signal conditioning performed by system.

        4. Conversion to engineering units.

5. Up to 5 alarm limits with deadbands (including hi/hi, lo/lo and delta) assignable individually to every analog input. Alarm enable and disable capability. Optional system alarm and report zoning for grouping points and assigning those groups to chosen terminals.

6. Complete diagnostic routines.

7. Generation and scheduling of demand reports, with user-definable and configurable process parameters.

8. Multiwindow real-time display.

9. Point callup by tag number as well as hardware address with alphanumeric descriptors on each point.

10. Selection of process data by point, groups of points, or all points.

11. Choice of scan rates, plus off scan, for assigning point priorities.

12. Optional math package for calculating averages and max/min, square root, and differential.

13. Multiple levels of system security, operator login, and password protection.

14. Communication with other computers.

15. Optional report definition, scheduling, and serial data link (including IBM PC).

g. **Software support:** Intel: RMX 86 operating system. Application programs are in Pascal.

h. **Vendor support:** Field service and maintenance contracts available. Assistance concerning installation, startup, and operation.

V-1-2. **Product name and abstract:** AIM. The AIM system is a family of standard software packages designed to be used for rapid implementation of computer control systems. Single control loops may be monitored and controlled with Base AIM. Single or multiple processes can be monitored and controlled using the

Batch AIM system. Remote data acquisition and control for automation and quality reporting is achieved with Distributed AIM.

a. Application: Automated industrial monitoring and control.

b. Company: Biles and Associates
                   6161 Savoy Drive
                   Houston, TX 77036
                   (Phone) (713) 789-8880

c. Pricing: License fees range from $36,000.00 to $50,000.00 depending on CPU.

d. Hardware support: DEC PDP-11, VAX families, and HP 1000 series computers (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-6, 5,and 9, respectively).   Memory requirements vary. Multiple color graphics terminals, variety of disk and tape storage devices, high-speed printers and plotters, links to EDP computer.

e. Compatible instruments: Programmable controllers, distributed control systems, data loggers, and process analyzers by many manufacturers, including: Fisher Provox, Honeywell TDC-2000, Burr-Brown CPI, Allen-Bradley PLCs, Modicon PLCs, Bailey Controls Network 90, Rosemount Diogenes, and Taylor Instruments.

f. Features:

    1. Self-documenting "fill-in-the-blanks" language for user-friendly specification of process inputs and outputs.

    2. Color graphic process visibility for interactive operator communications.

    3. Distributed analog and digital data acquisition and control using a variety of area networks.

    4. Historical data recording, retrieval, display, and analysis optional.

    5. Access to real-time process data base by user written FORTRAN programs.

    6. Analog input scanning, limit checking, alarming, and engineering unit conversion at selectable rates.

<u>7</u>. Interactive interpreter for arithmetic and logical control.

<u>8</u>. Continuous and sequential control using prewritten algorithms and user-prepared recipes.

<u>9</u>. Fully-developed, field-proven and operating in a variety of industry applications.

<u>10</u>. Process I/O interface optional.

g. <u>Software support</u>: Language is FORTRAN. Biles and Associates estimates that 20% to 30% of the application needs will be answered by custom software, which they are willing to provide for a fee.

h. <u>Vendor support</u>: Help screens, user manual, operator console manual, systems manual. One man-week start-up assistance.

V-1-3. **Product name and abstract**: ASYST. ASYST is comprised of four completely integrated modules. Module 1 which establishes the system includes arithmetic and basic statistical functions and all graphics capabilities, as well as a programming language. Modules 2 and 3 may be used together or separately, and their capabilities include a built-in programming environment, database management, polynomial and matrix arithmetic, curve fitting, and filtering. Module 4 is an IEEE 488 interface.

a. <u>Application</u>: Data acquisition, control, analysis, and graphics.

b. <u>Company</u>: Macmillan Software Company
866 Third Avenue
New York, NY 10022
(Phone) (212) 702-3241

c. <u>Pricing</u>: Total system - $2195.00.

d. <u>Hardware support</u>: IBM PC, PC/XT, PC/AT, and compatibles (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-6 through 19, 3, and 4, respectively); minimum memory 320-kbyte RAM; one

double density disk drive plus one additional drive, hard disk optional; IBM color graphics board with compatible monitor - RGB or composite; 8087 math coprocessor. User may select from a choice of printers and plotters: IBM dot matrix and graphics printers, IDS, Epson, Okidata, Gemini dot matrix printers, Hewlett-Packard 7470 or 7475 plotter (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-10-6, 1 through 7, and IV-11-2, respectively).

e. <u>Compatible instruments</u>: Data Translation DT2801 Series board, DT2805, DT2805/5716, DT2808; Tecmar Lab Master, Lab Tender, DADIO, Base Board; Keithley DAS Series 500; IBM GPIB Adapter; National Instruments GPIB-PC, GPIB-PC2, and GPIB-PC2A; the Capital Equipment PC-488 model 01000-00300; and Metrabyte IEEE-488 (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-3-6 and 10).

f. <u>Features</u>:

1. Command-driven scientific software fully integrates real-time data acquisition, data analysis, and graphics.

2. Supports analog inputs with programmable gain, analog outputs, digital I/O, DMA, programmable clock, and external triggering functions of DT2801 series boards.

3. Supports up to 16 DT2801 Series Boards simultaneously.

4. Synchronization to IBM-PC real-time clock.

5. Real-time data acquisition sampling speed, including continuous throughput to disk, up to 27,500 samples per second.

6. Eight-bit internal precision arithmetic provides fast execution of trigonometric function, complex numbers, and statistics.

7. "Command" statements eliminate complex computer programming. Complete user-defined routines may be assigned to single function keys.

8. Real-time data analysis features: superfast Fast Fourier Transforms (FFTs); substantial vector, matrix, array and scalar handling abilities; polynomial operations; eigenvectors and
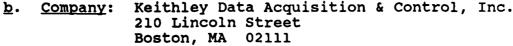
eigenvalues; least squares programs, data smoothing, filtering, and peak detection.

9. Built in "spreadsheet-like" array editor manipulates and edits data.

10. Interactive graphics display multiple windows, and label and scale graphs automatically.

11. Foreground/background multi-tasking enables user to sample data.

12. Sends commands and reads data using talker/listener scheme of the IEEE-488 protocol and offers a set of higher level words which may replace many IEEE-488 commands. Communicates over the bus in 3 modes: synchronous, asynchronous, and DMA.

g. <u>Software support</u>: PC DOS 2.0, 2.1, 3.0, 3.1 or equivalent. ASYST is written in a hybrid of assembler and a FOURTH-like language.

h. <u>Vendor support</u>: On-line help, demonstration program diskette, tutorial manual, and user manual.

V-1-4. **Product name and abstract**: CHIPS. This general purpose software system is designed to control industrial processes for relatively small systems. The user defines monitoring and control system with minimal or no programming. Plant personnel interface is a CRT.

a. <u>Application</u>: Data acquisition and control.

b. <u>Company</u>: WECON Process Systems, Inc.
10453 Greenbough, Suite 300
Stafford, TX 77477
(Phone) (713) 499-7575

c. <u>Pricing</u>: CHIPS, $20,000.00. Total system price, including hardware, $53,900.00.

d. <u>Hardware support</u>: DEC microprocessor, transportable to other CPUs. System price includes: hard disk-based LSI-11, HMW color terminal with keyboard, DEC LA-100 console and graphics-reports printer, one modem, and DEC VT-220 engineering/programming manual (see

"Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-5 and 6).

e. Compatible instruments: Conventional multiplexer/ analog-to-digital converter, remote terminal units (RTUs), data loggers, "smart" analyzers, and front-end processors supplied by many manufacturers, including: ADAC, CPI, Standard Engineering, Burr-Brown, Square D, Yokigawa, and ACROMAC (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-14-11).

f. Features: Features include the following:

1. Adaptable to a number of different manufacturers' hardware.

2. Modular system designed to be compatible with a number of types of process input/output (I/O).

3. No inherent limit in software for maximum points.

4. Scan rate determined by user-selected hardware.

5. Conversions include: linear, square root, and T/C.

6. Get/put subroutines callable from user-written FORTRAN programs.

7. Each input/control block may be disabled and a manually entered value substituted for its output in order to DEBUG.

g. Software support: Language: FORTRAN 77. I/O interface included in total system price. RSX-11M or M+ operating system.

h. Vendor support: License for fee covers one week of operator training and on-site installation assistance. HELP screens are provided.

V-1-5. **Product name and abstract**: DADiSP. Program DADiSP offers a totally menu-driven approach to data acquisition and control, as well as waveform manipulation and analysis. It completely automates experimental procedures in scientific and industrial applications.

a. Application: Data acquisition and analysis.

b. **Company:** Keithley Data Acquisition & Control, Inc.
210 Lincoln Street
Boston, MA 02111
(Phone) (617) 423-7780

c. **Pricing:** DADiSP I, $800.00; DADiSP II, $1,000.00; DADiSP I and DADiSP II, $1,600.00.

d. **Hardware support:** IBM PC, PC/XT, or PC/AT (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-16 through 19) with a minimum memory of 384 kbytes of RAM; color monitor; 8087 coprocessor (optional); one 360-kbyte floppy disk drive and a second disk drive, either floppy or hard disk; IBM graphics card.

e. **Compatible instruments:** Keithley series 500 measurement and control system.

f. **Features:** The three fundamental experimental procedures of setting parameters, recording data, and performing analysis are divided into two modules.

1. Module I offers setup, data storage, and display functions. The amount of information stored as one channel is limited only by the amount of memory available in the system. The display may be up to four windows, displaying signals from four data sets.

2. Module II offers advanced analysis functions and graphing. The functions range from arithmetic to advanced trigonometric and hyperbolic functions to statistics to frequency domain transformations. The analysis functions contained in Module II accept data from files stored in Module I, as well as data files from Soft500, Lotus 1-2-3, or ASCII formats.

The DADiSP software provides file transfer utilities for Lotus 1-2-3, MacMillan ASYST (see para. V-1-3), Soft500, and most ASCII-formatted files.

g. **Software support:** Soft500 version 2.0 software diskette; MS-DOS 2.0, 2.1.

h. **Vendor support:** One year warranty; toll-free HELP telephone service.

V-1-6. **Product name and abstract**: DAIS (Data Acquisition Information System). This is a modular package for database generation, data acquisition and reduction. System diagnostics, utilities, and documentation support are included.

    <u>a</u>. <u>Application</u>: Data acquisition and control.

    <u>b</u>. <u>Company</u>:   Systems Application Engineering, Inc.
                      3655 Westcenter Dr.
                      Houston, TX 77042
                      (Phone) (713) 783-6020

    <u>c</u>. <u>Pricing</u>: Sublicense available through ADI. License pricing: multiple systems - $50,000.00. Source code - $15,000.00.

    <u>d</u>. <u>Hardware support</u>: MACSYM 150; also up to 15 MACSYM 200 front ends; 512-kbyte minimum memory; ADIO or Series 100 I/O cards, color display screen, dual floppy disk drives, or optional 10-Mbyte hard disk. Keyboard and one or more printers.

    <u>e</u>. <u>Compatible instruments</u>: Analog Devices, Inc. (ADI) measurement and control systems products.

    <u>f</u>. <u>Features</u>:

        <u>1</u>. DAIS allows user to create and maintain database "tags" (values to be monitored) and their attributes for data acquisition, conversion to engineering units, alarm processing, state monitoring and updating history records while on-line. Alarm and event records appear on printer. All commands are accessed by function keys revealing submenus.

        <u>2</u>. The operator interface offers overview, groups of "tags", single "tag", engineering maintenance display, graphic and tabular display of trends, and alarm summaries. Alarms may be suppressed or enabled. DAIS can be augmented by user programming in MACBASIC.

    <u>g</u>. <u>Software support</u>: CP/M-86 operating system; language: MACBASIC.

    <u>h</u>. <u>Vendor support</u>: Complete manual set, support hot line, air space replacement program, warranty extensions, user configurability. As part of turnkey installation,

full spectrum of user support provided from job specifications through custom additions and long-term maintenance.

V-1-7. **Product name and abstract**: DARAD-150. Program DARAD-150 software provides for data acquisition, reduction, and display on the Hewlett-Packard 150 series computers (touchscreen). It is a set of programs written in compiled BASIC that operates on HP 150 computer systems that use either the HP 3421 or the HP 3497 data acquisition/control units. The system is designed to provide functions used in typical measurement system data acquisition applications as a user-installed package.

    a. **Application**: Data acquisition, analysis, and display.

    b. **Company**:   Demand Systems, Inc.
                      6279 Variel Ave., Suite D
                      Woodland Hills, CA 91367
                      (Phone) (818) 710-8851

    c. **Pricing**: $495.00. Quantity discounts are available.

    d. **Hardware support**: HP 150 series computers (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-2-14).

    e. **Compatible instruments**: HP 3421 and HP 3497 (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-14-4 and 6, respectively).

    f. **Features**: No programming knowledge is required. It supports all capabilities of the front-end hardware. Easy operator entries specify program/function control and system configuration by touchscreen. Automatic thermocouple data reduction for chromel/alumel and iron/constantan T/Cs. There are monitors for low/high alarm limits. It produces polynomial coefficients up to the 5th order, based upon a least squares fit of operator-entered data points. Measurements are scanned; converted to engineering units; and tabulated on the CRT, printer, or both at a specified interval by the program in real time or retrieved from the database. Data may be stored (at a specified scan rate and test duration) to a file, and selectively retrieved and tabulated. Samples and plots up to four channels in real time continuously.

g. Software support: Language: compiled BASIC.

h. Vendor support: User's manual.

i. Comments: The HP 150 computers may use a parallel interface card and a stepper interface card for control applications.

V-1-8. **Product name and abstract:** DARAD-200. This is a set of programs written in BASIC that operates on Hewlett-Packard 200 computer systems using the HP 98640A analog-to-digital interface card in conjunction with the HP 98645A measurement library, or the HP 3421A or 3497A data acquisition/control units. The system is designed to provide functions used in typical measurement system data acquisition applications as a user-installed package.

a. Application: Data acquisition, analysis, and display.

b. Company: Demand Systems, Inc.
                    6279 Variel Ave., Suite D
                    Woodland Hills, CA 91367
                    (Phone) (818) 710-8851

c. Pricing: $995.00. Quantity discounts are available.

d. Hardware support: Designed for the HP 200 computer systems using the HP 98640A (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-2-15).

e. Compatible instruments: HP 3421A and HP 3497A (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-14-4 and 6, respectively).

f. Features: No programming knowledge is required. Easy operator entries specify program/function control for configuration and operation. There is automatic thermocouple data reduction for chromel/alumel and iron/constantan T/Cs. Samples and plots a measurement channel at a specified interval. Graph limits are set by the operator. An estimate of trending data may be established by sampling data and calculating a linear regression (fit) of the data. Confidence levels are determined statistically. Monitors for high/low alarm limits and alarm messages are logged. Produces polynomial coefficients up to the 5th order, based on

the least squares fit of operator-entered data points. Measurements are scanned; converted to engineering units; and tabulated on the CRT, printer, or both at a specified interval by this program. Statistics, such as mean, standard deviation, integrated value, and maximum and minimum values, are established by the program. Additionally, a histogram is tabulated and a normal probability analysis is calculated. Data may be stored (at user-specified scan rate and test duration) to a file, and retrieved and tabulated. Samples and plots up to three channels in real time continuously. Specified time domain data are scanned or retrieved from file; a Fast Fourier Transform (FFT) is calculated; resulting frequency domain data are plotted followed by power spectrum and auto correlation calculations and plots. These functions are useful for signal analysis applications.

g. Software support: Language BASIC - HP 98645A Measurement Library.

h. Vendor support: User's manual.

V-1-9. **Product name and abstract**: Data Acquisition Pac, (HP 44468A). The Data Acquisition Pac turns the HP 41CV hand-held calculator into a dedicated system controller for the HP 3421A. A special control ROM allows data logging and the time module offers automatic periodic measurements and saves battery life by permitting the data logger to enter a "sleep mode". It can be combined with the Digital Cassette Drive and Thermal printer for data storage and printout.

a. Application: Data acquisition.

b. Company: Hewlett-Packard
                     P.O. Box 10301
                     Palo Alto, CA 94303
                     (Phone) (818) 506-3700

c. Pricing: $100.00 retail; $94.50 on GSA discount.

d. Hardware support: HP 41CV hand-held calculator, HP 82182A time module, HP 82162A thermal printer, and HP 82161A digital cassette drive (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-6-4).

e. <u>Compatible instruments</u>: Hewlett-Packard 3421A data acquisition/control unit (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-14-6).

f. <u>Features</u>:

1. Control ROM contains a "HP 3421A front panel" routine offering complete measurements (temperature, voltage, resistance, or frequency) or control functions on the HP 41CV keyboard. Provides a convenient way to check or debug the system.

2. Control ROM "Data Logger" routine offers data acquisition, measuring up to 30 channels via the HP 3421A option 020 multiplexer assembly.

3. The third and most flexible section of the HP 3421A control ROM is the HP 3421A special instruction set, which is designed to minimize the amount of programming necessary.

g. <u>Software support</u>: Not available.

h. <u>Vendor support</u>: Not specified.

V-1-10. <u>Product name and abstract</u>: Data Acquisition Software. (HP 14855AA, HP 14856AA). This menu-driven program performs voltage scanning, thermocouple scanning, and analog recording. It also includes a graphics utility for presenting information in a simple listing, linear graph, or logarithmic plot form.

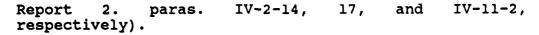a. <u>Application</u>: Data acquisition and graphics.

b. <u>Company</u>:   Hewlett-Packard
                        P.O. Box 10301
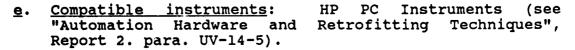   Palo Alto, CA 94303
                        (818) 506-3700

c. <u>Pricing</u>: $400.00

d. <u>Hardware support</u>: HP 150 Touchscreen or IBM PC with 640-kbyte RAM, and HP 7470A or HP 7475A plotters (see "Automation Hardware and Retrofitting Techniques",

Report 2. paras. IV-2-14, 17, and IV-11-2, respectively).

e. <u>Compatible instruments</u>: HP PC Instruments (see "Automation Hardware and Retrofitting Techniques", Report 2. para. UV-14-5).

f. <u>Features</u>:

1. The voltage scanner supports up to 2 relay multiplexers and one digital multimeter (DMM). Scans up to 16 channels at a rate ranging from 2 seconds for 3 channels in real time, to 8 seconds for 16 channels in list mode. The maximum number of samples is 3000.

2. The thermocouple scanner supports up to 2 relay multiplexers and one DMM. Scans up to 14 thermocouple inputs with compensation and linearization for T,J,E,R,K,S-type thermocouples. The fastest scan rate ranges from 5 seconds for 3 channels in real time to 25 seconds for 14 channels in list mode. The maximum number of samples is 3000. Temperature errors (include reference junction error, thermal-off voltages, and linearization error; do not include DMM or transducer errors) = ± 3.5 deg C.

3. The analog recorder supports up to three DMMs. Measures 1, 2, or 3 channels vs. time, or 1 or 2 channels vs. a third channel. Fastest sample interval ranges from 1 to 2 seconds. The maximum number of samples is 500.

4. The timebase range for all applications is 1 to 1800 seconds. Resolution is 1 second.

5. The graphics utility: 2 Y-axes; plots linear, semi-log, and log-log graphs.

g. <u>Software support</u>: MS DOS 2.11 or DOS 3.0 operating systems.

h. <u>Vendor support</u>: Not specified.

V-1-11. **Product name and abstract**: DDACS-1000. The system is designed for data acquisition and other measurement and control I/O applications. Source programs are provided to access

real-time and database data, and for user-defined special calculations or data reduction, if desired.

    a. Application: Data acquisition and control.

    b. Company: Demand Systems, Inc.
                      6279 Variel Ave., Suite D
                      Woodland Hills, CA 91367
                      (Phone) (818) 710-8851

    c. Pricing: $15,000.00

    d. Hardware support: HP 1000 Series CPU (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-2-9), Disk/tape cartridge, line printer/plotter, keyboard display (CRT), multiplexer/analog-to-digital converter, graphics display (B&W or color). Optionally: magnetic tape unit, hardware clock with display, terminal (logger), and speech output module.

    e. Compatible instruments: Hewlett-Packard 2250, 3497, and other HP front ends (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-14-4 through 6).

    f. Features: Features include the following:

        1. Tailored for HP 1000 series, hardware features such as graphics and terminal soft keys.

        2. Provides complete data retrieval and processing system capability in real time.

        3. Includes a versatile color process graphics generating system.

        4. Is designed for various measurement and control applications.

        5. Provides variable recording rates to both disk and tape.

        6. Has real-time trend plotting as well as history data trends.

        7. Has alarm acknowledgement and reset, and history display.

        8. Has closed and open loop control, real-time oriented control, start-up/shut-down controls, and status.

<u>9</u>. Has parameter and database set-up system, curve fit program, and configuration system.

<u>g</u>. <u>Software support</u>: RTEA with VC + operating system.

<u>h</u>. <u>Vendor support</u>: A DDACS tutorial and one day installation support are available. Operating, programming and installation manuals are provided. Source programs are supplied. A 90-day warranty is given. Software service contract is available, as well as complete project implementation service. Custom software is available.

V-1-12. **Product name and abstract**: DT/ILS-PC1. This is a command-driven, modular, signal processing software package. Capabilities include data scanning and manipulation, file management, waveform generation and display, statistical manipulation, digital filter design, and spectral analysis.

<u>a</u>. <u>Application</u>: Data acquisition, analysis, and display.

<u>b</u>. <u>Company</u>: Data Translation, Inc.
100 Locke Dr.
Marlboro, MA 01752
(Phone) (617) 481-3700

<u>c</u>. <u>Pricing</u>: $1495.00

<u>d</u>. <u>Hardware support</u>: IBM PC, PC/XT, PC/AT (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-16 through 18). 256-kbyte RAM. Two double-sided floppy drives, or one hard disk and one floppy drive. IBM or Hercules color graphics board or strictly compatible equivalent.

<u>e</u>. <u>Compatible instruments</u>: Data Translation DT2801 Series data acquisition and control boards.

<u>f</u>. <u>Features</u>:

<u>1</u>. Interactive, command-driven digital signal processing.

<u>2</u>. Supports analog input and output functions of DT2801 Series data acquisition and control boards.

<u>3</u>. Continuous data acquisition to disk at up to 27,500 samples per second (with DT2801-A).

4. Capabilities include waveform display and editing, digital filtering, and spectral analysis.

5. Supports Elliptic, Chebychev, Butterworth, and linear phase filter design and use.

g. **Software support**: IBM DOS 2.1 or higher operating system.

h. **Vendor support**: On-line HELP or menu-driven prompting. Comprehensive user's manual.

V-1-13. **Product name and abstract**: DT/NOTEBOOK. This menu-driven software package features real-time data acquisition, process control, and data analysis. Capabilities include automatic interface to analysis and spreadsheet packages, and advanced curve fitting analysis.

a. **Application**: Data acquisition, control, and analysis.

b. **Company**:   Data Translation, Inc.
                         100 Locke Dr.
                         Marlboro, MA 01752
                         (Phone) (617) 481-3700

c. **Pricing**: $795.00

d. **Hardware support**: IBM PC, PC/XT, PC/AT, and compatibles (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-16 through 19, 3 and 4). Two diskette drives, or one hard disk and one diskette drive. IBM color graphics board.

e. **Compatible instruments**: Data Translation DT2801 Series of analog and digital I/O boards.

f. **Features**:

1. Menu-driven software for real-time data acquisition, process control, and data analysis.

2. Supports up to 10 DT2801 series of analog and digital I/O boards.

3. Real-time data acquisition at up to 20,000 samples per second; continuous throughput to disk at up to 400 samples per second.

4. True foreground/background operation under MS-DOS.

5. Real-time graphic display of data at up to 600 samples per second.

6. Automatically interfaces to spreadsheet packages such as Lotus 1-2-3, Symphony, or RS/1 for data manipulation, reduction, and management and file manipulation; technical report generation (Symphony only).

7. Advanced curve fitting routine.

8. Forward and inverse FFTs for digital signal processing.

9. MAGIC/L can be optionally purchased for those who wish to customize the software.

g. **Software support:** IBM DOS 2.0 or 2.1 operating system. Language: MAGIC/L.

h. **Vendor support:** On-line HELP; comprehensive user manual.

V-1-14. **Product name and abstract:** Dynamik. This is a menu-driven software package with a powerful hardware system to monitor, record, measure, display, and respond to all sensory inputs.

a. **Application:** Data acquisition.

b. **Company:** DSP Technology
48500 Kato Rd.
Fremont, CA 94538
(Phone) (415) 657-7555

c. **Pricing:** Approximately $25,000.00 basic system price.

d. **Hardware support:** Basic package may include: 16 analog input channels, 16 analog output channels, 32 digital input channels, 32 digital output channels, termination panels, LSI 11-23 (see "Automation Hardware

and Retrofitting Techniques", Report 2. para. IV-2-6) resident in system chassis, dual floppy disk drive, printer, CRT. 32-kbyte minimum memory. VT100 terminal (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-7-2) with optional graphics, and Data System Design flexible or hard disk. Anadex 80-column dot matrix printer. Standard Engineering powered card cage model 425, Quantrol modules (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-14-11), and termination panels.

e. <u>Compatible instruments</u>: Quantrol hardware (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-14-11).

f. <u>Features</u>:

<u>1</u>. Collects data in real-time and logs on to a disk, tape, and/or printer.

<u>2</u>. Converts to engineering units and generates alarm warnings and messages.

<u>3</u>. Displays data in numeric or graphic form.

<u>4</u>. Calculates and logs dependent second and third-order variables.

<u>5</u>. An expanding set of termination panels is available to provide special amplification, filtering, reference temperatures, and conversions for analog measurements.

<u>6</u>. Supports 32 to 99 analog channels and 32 to 256 digital channels. Maximum scan speed is 50 channels per second.

g. <u>Software support</u>: Language: written in FORTRAN; accepts programs in RT-11 operating system.

h. <u>Vendor support</u>: As of September 30, 1985, Dynamik is not being supported by DSP. It may be supported in the future.

V-1-15. <u>Product name and abstract</u>: Enhanced ALERT. This software package collects data from a wide variety of sensor types, performs data quality control, manages the continuously

current data base, and provides alarms, analysis, forecast, and control functions. It is designed for hydrologic monitoring.

a. <u>Application</u>: Data acquisition and control.

b. <u>Company</u>:   International Hydrological Services
13 Westbrook Rd.
Bloomfield, CN 06002
(Phone) (203) 243-5311

c. <u>Pricing</u>: $3,650.00. GSA discount of 10.5% is available through Sierra Misco, Inc. Quantity discounts available.

d. <u>Hardware support</u>: IBM PC, PC/XT, PC/AT, or a 100% look-alike system (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-16 through 19, 3, and 4). Memory of 512 kbytes, used with 8088, 8086, or 80286 processor; 8087 or 80287 n th coprocessor; one 360-kbyte or 1.2-Mbyte diskette drive; 10-Mbyte (or more) hard disk drive; monitor adapter card and screen; one serial port for data collection; one parallel port for printer; one AST or Quadram clock card.

e. <u>Compatible instruments</u>: Sierra Misco instruments.

f. <u>Features</u>:

1. Full multiuser, multitasking, menu-driven operation.

2. Collects data from remote sensors via RS-232-C. After passing several quality control checks, the data are formatted and filed on either hard or floppy disk media. Data may be accessed manually from keyboard, or automatically by applications programs.

3. Data displays include: precipitation group displays, sensor group displays (from 1-8 sensors other than precipitation sensors), single sensor displays, precipitation maps. Complete line printer output.

4. Graphics include time series plotting routines for alphanumeric and color graphics monitors are available.

5. Alarms for HI, LO, delta, and alarm information display. The detection of alarm conditions can

initiate more elaborate alarms or control functions. Alarm disable capability.

6. Easy access by several users on-site or through remote terminals; password protection.

7. Database maintenance utilities.

8. Runoff forecast option.

g. <u>Software support</u>: UNIX look-alike operating system.

h. <u>Vendor support</u>: On-line user assistance; technical support services; and free software updates for a two year period.

V-1-16. **Product name and abstract:** FactoryLink. This package is comprised of: a Foundation Package providing system configuration via templates and menus, real-time data base, event timer, math and logic, alarm management, data logger, report generator, and compatibility with other DOS software; optional Dynamic Color Graphics; optional Programmable Controller Interface Software Driver with or without coprocessor; and a tool kit for programmers.

a. <u>Application</u>: Data acquisition and control.

b. <u>Company</u>:   USDATA
                        1551 Glenville Drive
                        Richardson, TX 75081
                        (Phone) (214) 680-9700

c. <u>Pricing</u>:   Foundation package: $2,750.00. Volume discounts available.

d. <u>Hardware support</u>:   DOS 2.0 (or later) IBM-PC-compatible computer (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-16 through 19, 3 and 4), 512 kbytes of RAM, floppy disk.

e. <u>Compatible instruments</u>:   Programmable controllers by Allen-Bradley; General Electric, Series 6; Gould-Modicon; Square D; Texas Instruments; and Westinghouse.

f. **Features:**

1. No programming skills required, but optional tool kit available to allow programmers to integrate device drivers and programs.

2. Open architecture and device independence.

3. Multitasking.

4. Real-time data base, real-time color graphics display.

5. Wide-band data imaging.

6. Alarm monitoring, prioritization, logging, display, and printing.

7. Works with Lotus 1-2-3 and other vendor's programs.

g. **Software support:** PC DOS 2.0 or later. Supports BASIC, "C", and Assembly.

h. **Vendor support:** User's manual. Annual support ($350) via telephone, software updates, maintenance and membership to users' group.

V-1-17. **Product name and abstract:** Factory-Pac 2. This package consists of software modules to provide computer-aided management of industrial operations. A specific module is installed to match the process interface device for programmable controllers. Factory-Pac 2 is completely menu-driven and requires no programming. All data logging criteria, graphics displays, and report generation information are specified in an initial set-up session.

a. **Application:** Data acquisition and control.

b. **Company:** Action Instruments, Inc.
8601 Aero Dr.
San Diego, CA 92123
(Phone) (619) 279-5726

c. **Pricing:** From $2,950.00 to $7,500.00 depending on options. Quantity discounts available.

d. Hardware support: IBM PC/XT (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-2-18) or 5531 industrial computer with 448-kbyte RAM. Medium resolution graphics adapter card; IBM color display or 5532 monitor; IBM monochrome monitor and adapter card; 8087 math coprocessor. Optional: High resolution monitor and graphics adapter, color ink-jet printer.

e. Compatible instruments: Programmable controllers, including: APAC-BC3 or BC10; Allen-Bradley PLC-2 Family; GE Series Six; TCS models 6342, 6358, 6433, 6434, 6830, 6850, Modicon, TI.

f. Features:

   1. Data acquisition is achieved either by an on-line logging module or off-line set-up module. The on-line logging module communicates with control or data acquisition hardware. Several logging models can be created, and logging activated by keyboard, specific sensor readings, or clock value. The off-line set-up module creates sensor files and logging models, but there are no options to invoke the logging models and no communication with the process. Warning messages are received. Separate modules create data files to be used by the data analysis module and the graphics module. This includes a spreadsheet with graphs such as bar charts, line charts, and more.

   2. Optionally, the FP2 graph is a graphic display of sensor states by linking them to shapes; the trend chart plots values of up to 4 sensors with real-time or historical data on a maximum twelve hour time scale.

g. Software support: PC DOS 2.1 operating system.

h. Vendor support: Manual, HELP screen, 90 day warranty.

V-1-18. **Product name and abstract:** IDBS-8000. This family of modular data bases can automatically recover data from GEMS data acquisition hardware as well as all other equipment using RS-232-C communications. It then reduces, prints, plots, and stores the results.

a. __Application__: Data Acquisition

b. __Company__: GEMS
                     190 West Rafferty Gardens, Unit 8
                     Littleton, CO 80120
                     (Phone) (303)794-1912

c. __Pricing__: $500.00 to $4000.00 depending upon modules chosen.

d. __Hardware support__: IBM PC family or compatibles (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-16 through 19, 3, and 4) with 256-kbyte to 0.5-Mbyte minimum memory. The program may be adapted to mainframes.

e. __Compatible instruments__: Keithley, Acurex, and any RS-232-C type data acquisition units, specifically GEMS PWL-47, RU-1330, and Terra Trac (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-15-1, IV-14-2, II-11-2, IV-19-1, and IV-15-5, respectively).

f. __Features__:

   1. The software currently handles the following instruments: piezometers, inclinometers, extensometers, plumblines, stress cells, weirs/flumes, meteorological instruments, survey/settlement monuments, analog transducers, and resistive transducers (thermocouples, thermistors, and Carlson gages).

   2. Menu-driven software can be configured to provide real-time monitoring and multitasking.

   3. "Out-of-limit" function, including automatic phone dialing and voice synthesized message generation.

   4. Output from the data base may be either in digital form for retransmission, or hardcopy tables or plots (both dot matrix and X-Y pen plots).

   5. Data trending plots or statistical data plots may be specially programmed.

   6. The plotting software is tailored to the user's hardware, so that the unique functions of the plotter are used.

g. Software support: Languages: written in BASIC, C, and Assembler. The data base may also access outside programs written in FORTRAN,PDL,etc.

h. Vendor support: Full support provided via telephone.

V-1-19. **Product name and abstract:** ILS-PC. This applications software system is made up of a number of programs for interactive digital signal processing. These programs include waveform analysis, statistics, and I/O support.

a. Application: Data acquisition and analysis.

b. Company: Signal Technologies, Inc.
                    5951 Encina Road
                    Goleta, CA 93117
                    (Phone) (805) 683-3771

c. Pricing: ILS-PC1 $995.00; ILS-PC2 $1495.00.

d. Hardware support: IBM PC, XT, or AT (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-16 through 18). 256-kbyte memory. Two floppy drives; IBM graphics board or Hercules board. Suggested use of IBM 8087 coprocessor. Supports IBM PC graphics printer.

e. Compatible instruments: Not applicable.

f. Features:

  1. Signal editing - ILS allows convenient display, editing, and manipulation of digitized single-channel or multichannel signals, regardless of signal characteristics or sampling frequency. Data segments may be marked with a cursor, moved within a file, zeroed, or transferred between files.

  2. Digital filtering - Classical firms of IIR filters (Elliptic, Chebychev, or Butterworth) and FIR filters (linear phase based upon McClellan, Parks, and Rabiner algorithm) may be designed with ILS. Filter coefficients are produced and stored by these programs, or they may be manually entered. A general purpose digital filter program performs time domain filtering.

3. <u>Data acquisition and validation</u> - ILS supports the full capabilities of selected A/D and D/A hardware. After digitization, data may be displayed and statistics computed to validate signals.

4. <u>Spectral analysis</u> - Time series functions are used to compute single FFTs and display power spectrums. Then multiple FFTs are computed and a three-dimensional graph is produced.

5. <u>Signal processing</u> - ILS allows the storage, display, and processing of integer, real, and complex data formats. Programs of Fourier Analysis, Spectral Density Estimation, Convolution, Correlation, etc. store results for subsequent display or processing.

g. <u>Software support</u>: PC DOS version 2.1 or later.

h. <u>Vendor support</u>: Single CPU license for supported system; complete documentation; 90-day software support. Additional one year telephone support for ILS-PC1 and ILS-PC2 is available for $375.

V-1-20. **Product name and abstract**: IMPACT-I. The IMPACT-I supervisory control and data acquisition (SCADA) system contains complete color graphic and report management packages with facilities for historical data collection, trending, and alarm/event handling. The system interfaces with the user through graphic and tabular displays. Menu-driven graphic and report editors allow users to customize the system on-line. The system can be configured as an intrinsically safe system for harsh conditions.

a. <u>Application</u>: Data acquisition, control, and graphics.

b. <u>Company</u>: Transmation, Inc.
977 Mt. Read Blvd.
Rochester, NY 14606
(Phone) (716) 254-9000

c. <u>Pricing</u>: Ranges from $75,000.00 and up depending on application and physical configuration.

d. <u>Hardware support</u>: DEC PDP-11 (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-2-6) or PDP micro series, dual disk drives, Aydin Controls'

color CRT and 45 function keyboard. 1-Mbyte memory capacity with on-line magnetic storage capacity upwards of 405 Mbytes.

e. <u>Compatible instruments</u>: Any manufacturer's remote terminal unit and/or programmable logic controller via RS-232-C or 20 mA.

f. <u>Features</u>:

   1. Monitors digital and analog inputs and converts to engineering units.

   2. Sets or clears digital outputs on operator command.

   3. Monitors for alarm conditions, informs the operator, and prints an alarm log. Supports a comprehensive failover system.

   4. Displays graphic diagrams showing updated status and engineering values.

   5. On request, monitors analog trends and displays the values.

   6. Prints operational logs at predetermined times or on request.

   7. Displays may be selected by methods ranging from user-defined display keys to light pen or track ball. Displays can be layered to allow user to magnify an area of a display. Bar charts, graphs, historical data, and trend information may be included in the display.

   8. Contains both arithmetic and Boolean logic packages. Math functions include square roots, exponential, trigonometric functions, and AGA 3 calculations.

g. <u>Software support</u>: Accepts FORTRAN programs.

h. <u>Vendor support</u>: Field service and maintenance contracts available. Assistance concerning installation, startup, and operation.

V-1-21. **Product name and abstract**: LABSOFT. This package monitors and controls application, sounds alarms, records data,

and provides real-time graphics. Requires external analytical packages to reduce data to engineering units and analyze data.

   <u>a</u>. <u>Applications</u>: Data acquisition and control.

   <u>b</u>. <u>Company</u>:   Cyborg
                          55 Chapel St.
                          Newton, MA 02158
                          (Phone) (617) 964-9020

   <u>c</u>. <u>Pricing</u>: $350.00. Purchaser qualifies for a special price on Lotus/Symphony.

   <u>d</u>. <u>Hardware support</u>: IBM PC/XT, AT (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-16 through 18), or IBM 5531.

   <u>e</u>. <u>Compatible instruments</u>: ISAAC 91-I, ISAAC 41-I, or IBM data acquisition and control adapter.

   <u>f</u>. <u>Features</u>:

       <u>1</u>. More than 40 commands for 12-/16-bit A/D, D/A, digital I/O, BCD I/O, thermocouple input, and signal averaging.

       <u>2</u>. Compatible with a wide variety of standard applications software including Lotus 1-2-3, Symphony, RS/1, and ILS. Combined with Lotus 1-2-3/Symphony, it transforms data into engineering units; analyzes data with built-in statistical and database functions; graphs results on a CRT, plotter, or printer; and writes and prints publication quality reports. Combined with ILS, it provides for data acquisition support, waveform display and editing, digital filtering, and spectral analysis. Combined with RS/1, it performs advanced multivariate statistics and plots graphs of data.

       <u>3</u>. Background/foreground capability allows computer to collect or output data in the background mode allowing user to perform other tasks without interrupting input or output.

       <u>4</u>. Real-time graphics, graphing temperature, flow, pressure, and stress/strain curves.

       <u>5</u>. Menu-driven data acquisition, PID loop control.

<u>6</u>. Analog inputs include: thermocouples, strain gages, RTDs, load cells, photocells, 4-20 mA, 0-20 mA, strip chart recorders, chromatographs, LVDTs, and signal processing.

<u>7</u>. Analog outputs include: motor control, pump control, furnace control, PID control, meters, and signal generators.

<u>8</u>. Digital inputs include: limit switches, magnetic flow meters, relay contacts, BCD devices, alarms, tachometers, encoders, logic pulses, and operator panels.

<u>9</u>. Digital outputs include: relays, lights, valves, stepper motors, and alarms.

<u>g</u>. <u>Software support</u>: Languages: BASIC, Compiled BASIC, FORTRAN, or C. Software applications packages include Lotus 1-2-3, RS/1, and ILS.

<u>h</u>. <u>Vendor support</u>: LABSOFT tutorial on disk, documentation, applications development assistance, installation and training assistance. Toll-free telephone hotline.

V-1-22. **Product name and abstract:** LABTECH Notebook. This integrated, general purpose software package features data acquisition, control, monitoring, and data analysis. It is menu-driven, requires no programming, and interfaces with analysis programs or spreadsheets.

<u>a</u>. <u>Applications</u>: Data acquisition, control, and analysis.

<u>b</u>. <u>Company</u>: Laboratory Technologies Corporation
255 Ballardville St.
Wilmington, MA 01887
(Phone) (617) 657-5400

<u>c</u>. <u>Pricing</u>: $795.00. Government and quantity discounts available.

<u>d</u>. <u>Hardware support</u>: IBM PC, PC/XT, PC/AT, or other compatibles (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-16 through 19, 3, and 4). IBM color graphics board or emulator, 256-kbyte RAM. Two diskette drives or one hard disk and one diskette drive.

e. <u>Compatible instruments</u>: Acrosystems Acro 900 Series; Cyborg 91I, 41I, I100, I110, I150; IBM DAC Adapter; Metrabyte Dash-8, Dash-16, EXP-16, DAC-12, PIO-12 (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-14-8); Action Instruments AI08, AI016; Data Translation DT 2801, 2801A, 2805, 2808; Interactive Microware ADALAB-PC; Taurus KS 100; Burr-Brown PCI 4301, PCI 4302; Datel ST705; Keithley Series 500; Tecmar Lab Master.

f. <u>Features</u>:

<u>1</u>. No programming required.

<u>2</u>. Data acquisition supports a wide variety of hardware interfaces. Sampling rates may vary from channel to channel and with time in one channel.

<u>3</u>. Process control may be open or closed loop.

<u>4</u>. Thermocouple linearization and compensation.

<u>5</u>. Real-time graphic display of data.

<u>6</u>. Continuous writing of data to disk during acquisition.

<u>7</u>. Foreground/background operation, allowing user to run other PC programs during data acquisition and control.

<u>8</u>. Automatically uses 8087 or 80287 floating point processors for speed in computation, if installed.

<u>9</u>. Menu-driven software.

<u>10</u>. Programming option to allow automation of experiment/test.

<u>11</u>. Programming language MAGIC/L commands fall into the following categories: branching and control, input/output, looping, NOTEBOOK defined functions (to start runs, etc.), DOS commands (can be used to execute DOS programs), arithmetic functions.

<u>12</u>. Advanced nonlinear curve fitting functions.

<u>13</u>. Interfaces to other programs for analysis, file management, and graphics, such as Lotus 1-2-3, Symphony, or RS/1.

g.   **Software support:** Language: MAGIC/L.   Vendors suggest use of Lotus 1-2-3, RS/1, or Symphony.   IBM DOS 2.0 or 2.1 operating system.

h.   **Vendor support:**   Complete tutorial; on-line HELP screens.

V-1-23.   **Product name and abstract:**   MAC/1000.   This comprehensive set of subroutines and programs provides an easy-to-use interface between application programs and measurement and control I/O using the HP 12060, 12061, 12062, or 12063 series automation interface cards, A-series CPUs, and the RET-A operating system.   The routines are designed to be called from user FTN77, BASIC, or Pascal application programs.   Optional FTN77 programs providing continuous high-speed acquisition and storage to disk are available and are easily customized by the user for a particular system configuration and need.

a.   **Application:** Data acquisition.

b.   **Company:**   Demand Systems, Inc.
                        6279 Variel Ave., Suite D
                        Woodland Hills, CA 91367
                        (Phone) (818) 710-8851

c.   **Pricing:**   User library, $500.00; continuous data acquisition programs, $500.00.

d.   **Hardware support:**   Hewlett-Packard 1000 CPU (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-2-9); 12060, 12061, 12062, or 12063 series automation interface cards.

e.   **Compatible instruments:** Not applicable.

f.   **Features:**

1.   Simplifies program development via high level calls.

2.   Provides vital functions not accomplished by hardware, such as zero shifting and voltage readings.

<u>3</u>. Has extensive error checking.

<u>4</u>. Has optional continuous data acquisition features which include user change control such as start/end channels and set-up disk modes.

<u>5</u>. Has analog input card functions including: enable/disable auto scan and external trigger, set analog input gain, get dynamic status from card, take analog input readings and return counts or volts, and correct for offset.

<u>6</u>. Has analog output card functions including: performs paced sequential single channel analog output; performs paced random, multiple channel analog output; and sets TTL logic level.

<u>7</u>. Has digital input/output card functions including: defines logic level for each channel; performs digital I/O; and interrupts service subroutines (read/write: interrupt mask word, bounce counter, sense/override register, and read interrupt status register).

<u>g</u>. <u>Software support</u>: RTE-A operating system.

<u>h</u>. <u>Vendor support</u>: Not specified.

V-1-24. **Product name and abstract**: MACQUISITION/ **MACONTROL.** With MACQUISITION, the user may define the application by using a simple spreadsheet template, automatically collect the data, and reduce the data for reports or charts. With MACONTROL, the user gets the additional functionality to set up complete control logic with decision criteria and also to collect statistics on the results.

<u>a</u>. <u>Application</u>: Data acquisition and control.

<u>b</u>. <u>Company</u>: Small Business Computers of New England
P.O. Box 397, 4 Limbo Lane
Amherst, NH 03031
(Phone) (603) 673-0228

<u>c</u>. <u>Pricing</u>: MACQUISITION: $450.00; MACQUISITION/MACONTROL: $695.00.

d. Hardware support: Apple Macintosh personal computer (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-2-1) (128- or 512-kbyte); Apple Imagewriter printer with Macintosh accessory kit, MacTaurus cable; Macintosh external diskette drive.

e. Compatible instruments: Taurus One/05 or Taurus One/10.

f. Features:

   1. Multiplan template used to define application: sequence for collecting data, number of samples to be taken, duration between samples, output template information, criteria for branching to a new sequence, and results desired.

   2. Multiplexer template may be sent to reduce the data and print a summary report.

   3. Digital input/output, analog input/output with 12-bit resolution. Maximum aggregate sampling rate in excess of 3000/second.

   4. Other Microsoft software such as Chart, File, and Word may use the data.

g. Software support: Microsoft BASIC (Macintosh), Microsoft MULTIPLAN (Macintosh).

h. Vendor support: On-site installation and training available as part of a total package arrangement.

V-1-25. **Product name and abstract**: **MAXS.** This modular software package is designed to handle laboratory automation and control. Modules consist of signal I/O, point and loop processing, operator console communication, historical storage (trending, events, and alarms), and enhanced user function.

a. Applications: Data acquisition and control.

b. Company: C & L Systems
1250 E. Ridgewood Ave.
Ridgewood, NJ 07450
(Phone) (201) 447-1454

c. Pricing: $12,000.00

d. Hardware support: HP 1000 computer (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-2-9).

e. Compatible instruments: HP 6940, 250, 6942, 3497, A-Series measurement and control cards, plus other HP-IB and RS-232-C devices (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-14-4 and 6).

f. Features:

  1. Multiple scan rates; all variables in engineering units.

  2. On-line addition, modification, and deletion of variables; on-line computational calculations.

  3. Hi/lo/delta alarms. An alarm can turn on a digital output, cause another variable to be processed, or a special alarm program may be scheduled to handle the condition.

  4. A library of routines allows the user to use programs for special purposes.

  5. Two forms of data plotting: historical data log or current trend plot.

  6. Alarm and event logging with reporting.

  7. Data may be stored in archives to either HP IMAGE data base or custom data base.

  8. Utility programs available for manipulating and displaying data are QUESTOR and QREPORT.

g. Software support: RTE-A series operating system. Archiving needs HP-IMAGE data base supported by QUESTOR and QREPORT for database management and report writing.

h. Vendor support: Documentation, reference manual, HELP processor. Training available per consulting rate. Customer phone-in support and software update subscription service available for $360 per month.

V-1-26. **Product name:** microMast-mt. This program is a supervisory control and data acquisition system developed
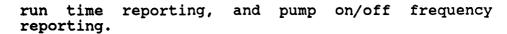
specifically for the clean water and waste water industries. The system performs remote terminal unit (RTU) data scanning, data logging, alarming, and reporting, and interfaces with standard database management, spreadsheet, and word processing.
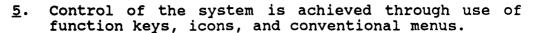
    a.   Application: Data acquisition and control.

    b.   Company: McClurkin Computer Corporation
                                 650 North Belt East, Suite 200
                                 Houston, TX 77060
                                 (Phone) (713) 445-5544

    c.   Pricing: $5,000.00 to $15,000.00

    d.   Hardware support: IBM PC-XT or PC-AT (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-16 and 18) with 512-kbyte memory (minimum), and a hard disk.

    e.   Compatible instruments: AMOCAMS supervisory control and data acquisition equipment (manufactured by AMOCAMS, Inc.).

    f.   Features:

        1.   Database generation and maintenance, including: define, generate, and modify files, records, and fields of data base. Define, add, modify, and delete RTUs and points in the data base.

        2.   Continuous scan of RTUs with support of multiple communication lines. User may define scan sequence and frequency, set an RTU on/off scan, and perform an analog high/low calibration test. The system automatically maintains RTU and point communication efficiency statistics, and produces a communication summary report hourly and on demand.

        3.   Data processing occurs at two levels: 1) the system monitors and processes conventionally acquired remote data such as analog I/O, digital I/O, and accumulators; and 2) the system converts raw data into application-specific units, including flows, valves, pumps, pump on/off controllers, tanks, tank level controllers, calculated values, and set points.

        4.   Processing occurs as data are acquired, periodically or on demand. Processing features include trending, historical data collection, pump

run time reporting, and pump on/off frequency reporting.

5. Control of the system is achieved through use of function keys, icons, and conventional menus.

6. Alarm conditions result from digital input changes, analog limits, deviations, rates of change, communication, and device-related faults. Numerous alarm attributes may be assigned to each point, including: acknowledge at a certain level or delete acknowledgement; reset or delete reset; alarm direction; suppress alarm/event log on alarm; audible alarm; and trigger action on alarm occurrence.

7. The following reports are generated periodically and on demand: data summary, alarm/event log, alarm summary, point detail, and communication efficiency summary. In addition, users may create customized reports in microMast-mt using the report language of the standard database management program.

g. Software support: Lotus 1-2-3 and dBase III may be used with the microMast data base or on a stand-alone basis. Language: "C".

h. Vendor support: Documentation, 2-day training course with one additional day on site. Maintenance and update support contract available.

i. Comments: AMOCAMS hardware may not be appropriate for the COE application. Check with McClurkin for the availability of drivers for other hardware products.

V-1-27. Product name and abstract: MIDAS (multi-tasking integrated data acquisition software). This general purpose data acquisition, monitoring, display and control software offers database and spreadsheet interface, fast monitoring scan time, simple modification of programs, and process graphic displays.

a. Applications: Data acquisition and control.

b. <u>Company</u>:   Megasystems
1075 Broken Sound Parkway NW
Boca Raton, FL 33431
(Phone) (305) 994-6700

c. <u>Pricing</u>: $3,490.00

d. <u>Hardware support</u>: IBM PC, PC/XT, PC/AT (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-16 through 18), 512-kbyte RAM. IBM standard color graphics board, 8087 Intel mathematics coprocessor, AST card with real-time clock and battery backup. At least one double-sided, double-density 320-kbyte diskette drive.

e. <u>Compatible instruments</u>: Megasystem's Signal/Processor or Super/Processor. Other front ends may be used, provided that specific drivers are written for them.

f. <u>Features</u>:

   <u>1</u>. Menu-driven with database and spreadsheet information.

   <u>2</u>. Fast monitoring scan time (approximately 2 seconds for 512 measurement points).

   <u>3</u>. Preconfigured for up to 512 digital and/or analog points in any combination. May be optionally configured for up to 8192 measurement points.

   <u>4</u>. Simple modification of programs.

   <u>5</u>. Standard displays include alarm, display log, and trendlines. Users are able to run their own programs concurrently within a window on the screen.

   <u>6</u>. Database editor allows user to create and subsequently change data base. The data base tells the system the kind of point, alarm limits, sensor type, hysteresis, description, location, etc.

   <u>7</u>. Continually updated alarm display reports channel number, description, time of alarm, status of alarm, and current value with engineering units.

   <u>8</u>. Display log displays the following items for each point: number, description, alarm status, current reading, and engineering units.

9. Real-time trendline is a visual representation of data recorded over a period of time. More than one trendline at a time may be displayed on the screen.

g. <u>Software support</u>: CP/M-86 or DOS operating systems. Optional spreadsheet with trendline.

h. <u>Vendor support</u>: Not specified.

V-1-28. **Product name and abstract**: miniMast. Program miniMast is a supervisory control and data acquisition system developed specifically for the clean water and waste water industries. The user may interactively create, control and modify his system to perform remote terminal unit (RTU) data scanning, data logging, alarming, reporting, and other standard SCADA functions.

a. <u>Applications</u>: Data acquisition and control.

b. <u>Company</u>: McClurkin Computer Corporation
650 North Belt East, Suite 200
Houston, TX 77060
(Phone) (713) 445-5544

c. <u>Pricing</u>: $15,000.00 - $60,000.00

d. <u>Hardware support</u>: Perkin-Elmer 32-bit minicomputer (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-2-21) with 1-Mbyte minimum memory. Winchester drive and one of the following for backup: removable disk, streaming cartridge tape drive, or magnetic tape drive.

e. <u>Compatible instruments</u>: AMOCAMS supervisory and control data acquisition system.

f. <u>Features</u>: The several integrated subsystems are outlined as follows:

1. Database generation and maintenance, including definition, generation, and modification of records, files, and fields of the data base. Definition, addition, modification, and deletion of RTUs and points in the data base. The ability to add and modify the interactive screen displays, including changes to format, color, and content.

2. Continuous scan of RTUs with support of multiple communication lines. User may define scan sequence and frequency, set an RTU on/off scan, and perform an analog high/low calibration test. The system automatically maintains RTU and point communication efficiency statistics, and produces a communication efficiency summary report hourly and on demand.

3. Data processing occurs at two levels. First, the system monitors and processes conventionally acquired remote data, such as analog I/O, digital I/O, and accumulators. Secondly, the system converts raw data into application-specific units, including flows, valves, pumps, pump on/off controllers, tanks, tank level controllers, calculated values, and set points.

4. Processing occurs as data are acquired, periodically or on demand. Processing features include trending, historical data collection, pump run times reporting, pump on/off frequency reporting, and control procedures.

5. The user controls and interacts with the system by means of a display station, consisting of one or more color graphic CRTs, a function keyboard, and (optionally) a light pen. The user accesses system information through color graphic display. The user controls the system by using dynamically redefined function keys and conventional menus.

6. Alarm conditions result from digital input changes, analog limits, deviations, rates of change, and communication and device related faults. Numerous alarm attributes may be assigned to each point, including: acknowledgement at a certain level or delete acknowledgement, reset or delete reset, alarm direction, suppress alarm/event log on alarm, audible alarm, and trigger action on alarm occurrence.

7. The following reports are generated periodically and on demand: data summary, alarm/event log, alarm summary, point detail, and communication efficiency summary. In addition, miniMast provides a report-oriented language and a special task that allow users to create, modify, and delete their own reports interactively in real time.

g. <u>Software support</u>: Languages: FORTRAN, Assembler.

h. Vendor Support: Documentation and a one-week training course with an additional two days on-site training. Maintenance and update-support contract available.

i. Comments: AMOCAMS hardware may not be appropriate for the COE application. Check with McClurkin for the availability of drivers for other hardware products.

V-1-29. **Product name and abstract:** NDAS-PC. This menu-driven data acquisition software package allows the user to read, record, convert to engineering units, and display data, as well as output control functions. It may be used with packages such as Lotus 1-2-3 or Symphony for data analysis.

a. Application: Data acquisition.

b. Company: Neff Instruments Corp.
                         700 S. Myrtle Ave.
                         Monrovia, CA 91016
                         (Phone) (800) 423-7151

c. Pricing: $860.00

d. Hardware support: Included in price are: 1) IEEE-488 interface card, and 2) cable for IBM PC/XT host computer. See "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-2-18.

e. Compatible instruments: Neff System 470 (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-14-9).

f. Features:

    1. The CRT leads the user through the system hardware definition, scan list setup, and the specifying of parameters for engineering units conversion. The operator enters scan list and rate of recording information. The output list may be dynamically modified from the keyboard during operation. Output may go to CRT or printer, and a disk file.

    2. NDAS-PC provides facilities for sorting recorded data to analysis packages such as Lotus 1-2-3 or Symphony.

g. <u>Software support</u>: DOS version 2.1 operating system. Separate package needed for data analysis. Language: BASIC.

h. <u>Vendor support</u>: Not specified.

V-1-30. **Product Name and abstract**: OCTASOFT. This application software package is designed for use with OCTAPAK, an eight-channel process data acquisition unit (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-14-1). Together they provide data logging, input, alarm monitoring, and digital alarm outputs.

a. <u>Applications</u>: Data acquisition and alarm.

b. <u>Company</u>:   Action Instruments, Inc.
                            8601 Aero Dr.
                            San Diego, CA 92123
                            (Phone) (619) 279-5726

c. <u>Pricing</u>: $495.00

d. <u>Hardware support</u>: IBM PC, PC/XT, PC/AT (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-16 through 18), or 5531 with 256-kbyte RAM with color monitor. For alarm outputs: AICP-DOM32 digital output card, 8-32 position isolated digital I/O rack. Supports Epson MX 80/100 or Epson FX 80/100 printer.

e. <u>Compatible instruments</u>: Action Instruments' OCTAPAK.

f. <u>Features</u>:

  1. Monitors up to sixteen OCTAPAKs (128 input channels). A menu-driven display mode can monitor up to 16 inputs as they are continuously scanned and updated.

  2. Runs other programs simultaneously.

  3. User configures each input channel for input name, scaling, linearization, optional filtering, engineering units, alarm set points, deadband and mode: limit (hi/lo), differential or rate-of-change alarm operation.

4. Real-time display of up to 16 channels per screen in either tabular form or a high resolution bar graph.

5. User may configure up to seven different printout modes based on chart recording, data logging, and alarm logging.

6. Printer output may be written to disk file.

7. Split screen alarm panel displays alarm statuses for each input from all OCTAPAKs. Operator may enable or disable alarms by toggle.

8. OCTASOFT's print features include: chart recorder feature, data logging print selection, and alarm logging.

9. OCTASOFT allows the use of Action Instruments' AICP-DOM32 digital output board to provide alarm outputs for driving external devices. Up to 128 alarm outputs may be provided.

g. Software support: DOS 2.1 operating system.

h. Vendor support: HELP screens, user's manual available for $15.00.

V-1-31. Product name and abstract: ONSPEC control software. The control software package is a set of seven modules providing the following functions: display of color process graphics or tabular displays; trend of process variables; alarm; historian data log; log row and column reporter; a spreadsheet program; writer, a program and report editor; Pascal compiler and linker with interrupt and overlay implementation; and multi-tasking operating systems to support four virtual consoles and access up to 254 independent tasks.

a. Application: Control.

b. Company: Heuristics, Inc.
9723 Folsom Blvd., A231
Sacramento, CA 95827
(Phone) (916) 369-6606

c. <u>Pricing</u>: $3,995.00

d. <u>Hardware support</u>: IBM PC/XT and true IBM compatibles (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-16 through 19, 3, and 4), TI Professional, DEC Rainbow. 320-kbyte memory and 2 double-density disk drives. Color monitor, IBM or Epson MX 80 printer, 8087 math coprocessor.

e. <u>Compatible instruments</u>: Action Instruments Acupak, Octopak; Acurex Netpak (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-14-2), AutoCalc; Adatek Powr-Spec.; Allen Bradley Data Highway; Analog Devices Mac 4000, Mac 5000; Bailey Net 90; Burr Brown Cinch Pak; ETI Micro Gateway; Fischer and Porter Supervisor; GE Series 6; Honeywell LCI, TDC, UDC 500; Modicon Modbus; Opto 22; Taurus; Texas Instruments 500 Series; Westinghouse Numa-Logic; Yokigawa.

f. <u>Features</u>:

   1. Display - dynamically refreshed color process graphic displays designed using ISA process or tabular displays (ISA graphic symbols reside in a supplied EPROM).

   2. Help - HELP function and user-configured HELP screens aid operators with application-specific information.

   3. Writer - an editor for shift logs, reports, and programs.

   4. Reporter - spreadsheet program for acquired and manually entered data.

   5. Historian - compressed and time-stamped data log with status arranged by time series for analog and digital values.

   6. Trend - trends of process variables that may be combined with graphic or tabular displays.

   7. Alarm - prioritized alarm scheme with messages, a history file, display attributes, and user-defined alarm logic.

   8. Control - PID control blocks and other common control elements suitable for supervisory control may be supplied upon request.

9. Multitasking - four virtual consoles running four tasks in four "windows" on CRT, access up to 254 independent tasks.

g. <u>Software support</u>: Language: Pascal and some Assembly. Other languages such as BASIC, FORTRAN, and C are able to access real-time data. A Pascal compiler and linker are supplied.

h. <u>Vendor support</u>: Written problem report service is provided. A professional support subscription service is also available. User's manual, one year of user's notes and updates.

V-1-32. **Product name and abstract**: PACE/32. This is a flexible, preprogrammed, fill-in-the-blanks industrial software system that provides data acquisition, data conversion, alarm functions, custom calculations, historical record keeping and reporting, graphic trending, and process and supervisory control.

a. <u>Application</u>: Data acquisition and control.

b. <u>Company</u>: Gould, Inc., Computer Systems Division
6901 W. Sunrise Blvd.
Ft. Lauderdale, FL 33313-4499
(Phone) (305) 587-2900

c. <u>Pricing</u>: $27,500.00 for the Nucleus. Optionally: Historian Subsystem - $7,500.00; Control Subsystem - $4,500.00; and Failover Subsystem - $9,000.00.

d. <u>Hardware support</u>: Concept/32 computer (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-2-7) with a 2-Mbyte minimum main computer memory. Minimum 80-Mbyte disk drive. The maximum amount of memory required is system-dependent. Load device; asynchronous communications controller; at least one ISC 8001 G (or compatible) color CRT; FORTRAN 77 compiler.

e. <u>Compatible instruments</u>: Wide selection of Computer Product, Inc. process I/O interface equipment. Gould 584, 884, 984 programmable controllers (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-3-3).

f. Features:

1. Modular set of standard and optional software designed to monitor and control real-time industrial processes.

2. Reads signals including thermocouples, flow meters, and contacts, and converts raw data into engineering units. Conversions include thermocouple, polynomial, flow, RTDs, and accumulators.

3. Instrument limit violations and alarm conditions are detected and appropriate messages directed to the alarm response processor. Alarms may be reported to master alarm printer and to individual operator stations.

4. Field points can be grouped for different scan rates.

5. No programming required to perform custom interpretive calculations on acquired process data.

6. Database management with ability to modify data on-line or off-line.

7. Custom color graphics and tabular displays are generated by the FOCUS subsystem without programming.

8. Flexibility in scheduling and formatting reports.

9. Supports a complete trend display system and optional historical trending.

10. Application programs may be implemented using FORTRAN, Pascal, or Assembler. Pace/32 includes a comprehensive library of FORTRAN-callable subroutines to provide for accessing scan, alarm, calculation, and control data bases; checking points for alarms and distributing alarm messages; data conversion; CRT interface; name-to-number and number-to-name conversion; and routines to manipulate queues and linked-lists, etc.

Optionally:

1. Maintains and displays historical directory and display data base. Failover subsystem, control subsystem for complex control strategies without programming.

<u>2</u>. System limitation is 32,000 analog points, 32,000 digital points, 2,000 process control blocks, and 15 operator stations (each having up to four color graphic CRTs).

g. <u>Software support</u>: Languages: FORTRAN, Pascal, or Assembler. MPX-32. Version 3.2 operating system.

h. <u>Vendor support</u>: User's manual, programmer manual, and technical manual. Two training courses are available. Software maintenance is available for users who purchase source.

V-1-33. <u>Product name and abstract</u>: PC/DBS (Process Control/Data Base System). PC/DBS is a menu-driven software package that simplifies the design, implementation, and documentation of process control automation systems. A structured version of FORTRAN is also provided for developing specialized monitoring and control programs unique to a particular application.

a. <u>Application</u>: Data acquisition and control.

b. <u>Company</u>:   KineticSystems Corporation
                    11 Mary Knoll Dr.
                    Lockport, IL 60441
                    (Phone) (815) 838-0005

c. <u>Pricing</u>: Class A license on Winchester is $15,000.00.

d. <u>Hardware support</u>: DEC PDP-11 or LSI-11 with 512-kbytes (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-2-6). DEC FP11 floating-point instruction set. A 50/60 Hz system clock. A VT100, VT125 terminal (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-7-2) or equivalent for graphical displays, hard disk 20-Mbyte disk drive. Line printer or hardcopy. Terminal recommended. Crate controller: minimum of one KineticSystems Model 3923, 3920, 3920/2920, 3921, or 3952.

e. <u>Compatible instruments</u>: KineticSystems CAMAC hardware.

f. **Features:**

1. Database system for use in developing process control strategies.

2. User names and defines each hardware element and each process element.

3. User may define intermediate, non-I/O related, and storage elements for use in storing numbers. In addition, the user may define non-I/O related bits (software switches).

4. User may define alarm conditions for any process elements. Alarms and acknowledgements are logged.

5. User may select those process elements for which a trend report is desired. This report may be either a tabular printout or a graphical display.

6. User may define PID control loops, lead/lag transfer functions, on/off control loops, mathematical and Boolean element relationships and linear time-ranging functions.

7. User has ability to develop detailed control programs in FORTRAN and RATFIV using element names within the control program to access element values.

8. Three scan tasks interact with the process and update the data base. The current status of the process is thereby reflected in the data base. These three tasks allow for selection of a fast, medium, or slow scan rate for each I/O element.

g. **Software support:** DEC RSX-11M/M+ operating system, Version 4.1 or later. Languages: DCL, FORTRAN 77.

h. **Vendor support:** PC/DBS includes standard service as defined in the KineticSystems software support category. Installation by KSC is available for a nominal charge. On-site installation is available on a time and materials basis.

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V-1-34. **Product name and abstract:** PRO. The PRO software system is designed to monitor and control a process. It contains an on-line incremental compiler, a real-time executive

(RTE), a multi-tasking operating system, and software drivers necessary to interface with system I/O. This stand-alone system requires no other software except the user's own applications programming.

a. Application: Data acquisition and control.

b. Company: STAFF Computer Technology Corp.
P.O. Drawer B
Del Mar, CA 92014
(Phone) (619) 453-0303

c. Pricing: PRO license: $5,000.00 per use. Extended memory option: $2,500.00 per use. A discount schedule is available.

d. Hardware support: Requires about 32 kbytes of resident memory. DEC, PDP-11, LSI-11 (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-2-6), ASCII terminal.

e. Compatible instruments: I/O devices from ADAC and Computer Products, Inc.

f. Features:

1. User specifies scanning rate and alarming.

2. Controls algorithms for analog and digital output capability.

3. Supports background mode operation and on-line modification of tasks.

4. FORTRAN- and BASIC-like statements available for building user's tasks.

5. Over 150 analog points per second with computers of "average" computational speed; up to 500 points per second on faster machines. I/O points: up to 1000 each of digital inputs and outputs, 1000 analog inputs, and over 500 analog-type outputs with appropriate memory expansion; 32-kbyte system handles 30 each analog I/O, 100 each digital I/O.

g. Software support: This stand-alone system requires no other software except the user's own applications programming.

h. <u>Vendor support</u>: Manuals and limited telephone support service included. Training and consulting are available at extra cost.

V-1-35. <u>**Product name and abstract:**</u> Q.E.D. DAC. This menu-driven package provides graphics, data collection, process control, and data manipulation and analysis functions.

<u>a</u>. <u>Application</u>: Data acquisition, control, analysis.

<u>b</u>. <u>Company</u>: Hart Scientific
177 West 300 South
Provo, Utah 84603
(Phone) (801) 375-7221

<u>c</u>. <u>Pricing</u>: $849.00

<u>d</u>. <u>Hardware support</u>: IBM PC, PC/XT, PC/AT, and "workalikes" with a minimum of 256-kbytes of memory (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-3, 4, and 16 through 19). Optional use of the 8087 coprocessor. Also works on computers with UNIX operating systems.

<u>e</u>. <u>Compatible instruments</u>: This package supports Hart, Cyborg Isaac, IBM, Tecmar, and Data Translation hardware, as well as RS-232-C and IEEE-488 inputs.

<u>f</u>. <u>Features</u>:

<u>1</u>. Each channel may have separate instructions, thus allowing each channel to sample data at its own rate.

<u>2</u>. Control functions include open loop and closed loop control, PID, scheduling starts and stops, and alarm capabilities.

<u>3</u>. Advanced graphics allow creation of an unlimited number of windows, each of which may accommodate several traces. The graphics output may be rotated in 90-degree increments, making stripchart recorder emulation possible.

<u>4</u>. Monitors temperature, pressure, flow, strain, etc. The user may collect data from an unlimited number

of channels and direct incoming data, wherever desired.

5. The program can attach notes to the data to explain procedures and identify the who, what, why, and when of a task.

6. Provides the basic mathematical functions for data analysis, including polynomial curve fitting.

7. Q.E.D. DAC is file compatible with other software such ASYST, Lotus 1-2-3, RS/1, and TK! Solver.

g. Software support: UNIX operating system, PC DOS operating system.

h. Vendor support: Manual, HELP screens, toll free support hotline.   Free upgrades during first 90 days after purchase.

V-1-36. **Product name and abstract:** RCS-7. Program RCS-7 is a complete SCADA package. The software portion of the package includes the computer vendor's operating system and utilities and the RCS-7 executive software and standard modules. Provides basic necessities for control and data acquisition.

a. Applications: Data acquisition, control, and database management.

b. Company: SGM, Inc.
                   8830 Interchange Drive
                   Houston, TX   77054
                   (Phone) (713) 666-2701

c. Pricing: Varies with computer. Starting at $10,000.00 for object license on a DEC PDP-11/23. Source license is negotiable.

d. Hardware support: Runs on DEC VAX family and DEC PDP-11 family (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-2-6). Minimum memory is at least 1 Mbyte for PDP-11 family, at least 3 Mbyte on VAX.

e. Compatible instruments: RCS-7 interfaces with most current manufacturer's process I/O or RTUs.

f. **Features:**

1. Database generation builds and edits a real-time data base without programming or coding. Database information may be modified either off-line or on-line.

2. Data scanning gathers the data from remote devices. All data returned from the RTU are checked for communication errors. The software performs initial data processing to determine whether further processing is required.

3. Data processing performs limit checking, data integrity inhibit, and control inhibit.

4. Supervisory control software includes digital output capability. Parameter processing allows pertinent information to be downloaded to intelligent remote devices.

5. Alarm processing notifies the operator of alarm condition. User may specify a log of the alarm.

6. Operator station processing performs error checking and security checking. This supports interface of light pens, touchscreens, and on-line graphics editor of graphic or tabular diagrams.

7. Logging provides the operator with hard copies of important system events and displays. Capabilities include simultaneous output to multiple loggers, device failover between loggers, destination options such as printers, loggers, or terminals.

8. Format generation allows the operator to build or modify displays and reports.

9. Keyboard processing coordinates operator inputs with necessary processing.

10. Format retrieval and updating allows the operator to request displays that represent current field process conditions.

11. CRT data entry allows operator to change system database values.

12. Console security allows supervisory personnel to restrict operator access to system.

13. Device error processing/device failover provides constant error checking and redundancy among devices.

14. Disk file maintenance allows changes to disk resident system files.

15. Report generation allows an operator to build, print, and schedule hardcopy reports.

16. Historical database generation saves samples of real-time data for future use, such as logging, CRT display, or trending.

17. Failover provides full redundancy between a prime SCADA system and its backup.

18. Calculation processor allows the operator to devise, schedule, and execute calculations on data which may be retrieved from any system location (core, disk, data base) and store results in any system location.

g. Software support: RCS versions of DEC and MODCOMP series minicomputers are currently available. Versions for other models are available on a special quotation basis. Language: ANSI standard FORTRAN.

h. Vendor support: Software design document, system operations manual, programmer's reference manual, format generation manual, database generation manual, RCS-7 installation guide, and others as required. System integration, software services, and project consultation.

V-1-37. Product name and abstract: SNAPSHOT STORAGE SCOPE. SNAPSHOT is a menu-driven digital storage scope software package designed for users whose primary needs are data collection and real-time display of analog data.

a. Application: Data collection and display.

b. Company: HEM Engineering Co.
17025 Crescent Dr.
Southfield, MI 48076
(Phone) (313) 559-5607

c. Pricing: $495.00; 30-day risk-free trial period.

d. <u>Hardware support</u>: IBM PC, PC/XT, PC/AT, or compatible (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-16 through 19, 3, and 4) with 256-kbyte RAM minimum. One double-sided, double density floppy disk drive required, two recommended. Monochrome or color monitor with graphics capability.

e. <u>Compatible instruments</u>: Data acquisition boards by MetraByte Corp. (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-14-7) and Data Translation, Inc.

f. <u>Features</u>:

1. Digital- or analog-triggered acquisitions, and acquired data written to disk.

2. Real-time acquisition and display of four channels.

3. Sampling rate between 1 sample per 16 minutes and 50,000 samples per second.

4. Data displayed in graphic or tabular form.

5. Replay recorded data from disk for further visual analysis. Make a hard copy on the printer or photograph the screen.

6. Uses cursor and/or table functions to display time and voltage values.

7. Uses an internal or external trigger to start the data acquisition.

8. Acquired data may be analyzed with Lotus 1-2-3 or other commercial packages such as FFT analysis.

g. <u>Software support</u>: PC DOS 2.0.

h. <u>Vendor support</u>: Free upgrades for 6 months. After this period, discounted upgrades are available.

i. <u>Comments</u>: Future plans for sampling all 16 channels and extending the number of data points sampled in one "snapshot" from 18,000 to 32,000, plotting one channel vs. another in addition to channels vs. time, and spooling data directly to disk.

Analysis and Reduction

V-2-1. **Product name and abstract:** *COMPLEX MATH.* The COMPLEX MATH binary program adds complex number support to the BASIC language on HP 9826 desktop computers. Complex variables and arithmetic functions are fully supported and integrated into the standard HP BASIC language. The features provided include all the complex math capabilities of ANSI standard FORTRAN.

a. **Application:** Analysis.

b. **Company:** Structured Software Systems, Inc.
Box 1072 Irick Road
Mt. Holly, NJ 08060
(Phone) (609) 267-1616

c. **Pricing:** $975.00

d. **Hardware support:** Hewlett-Packard 9816, 9826, or 9836 (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-2-15). Minimum memory required is 21 kbytes.

e. **Compatible instruments:** Not applicable.

f. **Features:**

1. Complex numbers are treated in the same ways as integer and operations; the built-in functions of BASIC may be used with complex numbers. These include trigonometric functions, logarithms, exponents, square roots, and absolute value.

2. Several new built-in functions include hyperbolic trigonometric functions and complex conjugate. In addition, complex operations may be performed on entire arrays.

g. **Software support:** BASIC operating system (2.0 or later).

h. **Vendor support:** Phone-in consulting; mail-in support available.

V-2-2.   **Product name and abstract**: DynaSim. This is a research-level software module for dynamic systems experimentation and all applications involving differential equations. It will solve any system of first order ODEs (up to eight simultaneous equations) and graph the trajectory of the solutions.

<u>a</u>.   **Application**: Analysis.

<u>b</u>.   **Company**:   Interactive Arts
                                  2715 Porter St.
                                  Soquel, CA 95073
                                  (Phone) (408) 475-7047

<u>c</u>.   **Pricing**: $600.00

<u>d</u>.   **Hardware support**:   IBM PC or compatibles (see
         "Automation Hardware and Retrofitting Techniques",
         Report 2. paras. IV-2-16 through 19, 3, and 4) with
         128-kbyte memory; PC color graphics board or
         equivalent; MS Pascal compiler.

<u>e</u>.   **Compatible instruments**: Not applicable.

<u>f</u>.   **Features**:

         <u>1</u>.   Equations are entered by use of the text editor.
              User specifies initial conditions and control
              parameters.

         <u>2</u>.   The program carries out the integration process
              using numerical methods of the Runga-Kutta type
              with Butcher-Sarafyan error estimation.

         <u>3</u>.   The user may determine both integration step size
              and error tolerance.

         <u>4</u>.   The program plots the solution on a color monitor.

         <u>5</u>.   A complete log of all entries for each project is
              saved in a special input file for future reference.

<u>g</u>.   **Software support**:   PC DOS 2.0 or later.   Language:
         Pascal.

<u>h</u>.   **Vendor support**:   "Help" command, user's manual,
         telephone and E-mail access for user support. Two-week
         money back guarantee.

i. **Comment**: The capability to handle 16 or more equations is available by special order. Two-week money back guarantee.

V-2-3. **Product name and abstract**: GEOCONTOUR. This software package plots contours for an arbitrary set of data. The user inputs coordinates and known values at each coordinate together with the desired contour values. GEOCONTOUR uses linear interpolation to locate and draw contour lines. This program is useful in any application where one wishes to draw curves connecting locations with the same value.

a. **Applications**: Graphics.

b. **Company**:   DATACRAFT, Inc.
13714 S. Normandie Ave.
Gardena, CA 90249
(Phone) (800) 421-2289

c. **Pricing**: $500.00. See vendor for more information.

d. **Hardware support**: IBM PC-compatible (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-16 through 19, 3, and 4).

e. **Compatible instruments**: Not applicable.

f. **Features**: Not specified.

g. **Software support**: MS DOS.

h. **Vendor support**: Not specified.

V-2-4. **Product name and abstract**: GEOFLOW. This package provides a calculation to solve two-dimensional steady state seepage problems. GEOFLOW can solve confined and unconfined flow problems. The companion program, GEOPLOT, plots the solution as a flow net using a high quality pen plotter. Knowledge of groundwater flow principles and the finite element method is essential.

a. **Applications**: Analysis and graphics.

b. **Company:** DATACRAFT, Inc.
13714 S. Normandie Ave.
Gardena, CA 90249
(Phone) (800) 421-2289

c. **Pricing:** $500.00. See vendor for more information.

d. **Hardware support:** IBM compatible.

e. **Compatible instruments:** Not applicable.

f. **Features:** Not specified.

g. **Software support:** Not specified.

h. **Vendor support:** Not specified.

V-2-5. **Product name and abstract:** GEOSLOPE. This program, written in FORTRAN, determines the factor of safety for circular slip surfaces. An automatic search feature is included to locate the surface that gives a minimum factor of safety. GEOSLOPE allows different soil types, several ways to describe pore pressures, and options for surface loadings. Knowledge of soil mechanics is essential to establish input parameters and interpret the results.

a. **Application:** Determines factor of safety for circular slip surfaces.

b. **Company:** DATACRAFT, Inc.
13714 S. Normandie Ave.
Gardena, CA 90249
(Phone) (800) 421-2289

c. **Pricing:** $400.00. See vendor for more information.

d. **Hardware support:** IBM PC-compatible (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-16 through 19, 3, and 4).

e. **Compatible instruments:** Not applicable.

f. **Features:** Not specified.

g. **Software support:** MS DOS.

h. <u>Vendor support</u>: Not specified.

V-2-6. <u>Product name and abstract</u>: Lotus$^{(R)}$ 1-2-3$^{(R)}$.*
This software package provides spreadsheet analysis, information
management, and graphing.

  a. <u>Application</u>: Spreadsheet.

  b. <u>Company</u>:   Lotus Development Corporation
                          161 First Drive
                          Cambridge, MA 02142
                          (Phone) (617) 253-9150

  c. <u>Pricing</u>: $495.00

  d. <u>Hardware support</u>: IBM PC (see "Automation Hardware and
      Retrofitting Techniques", Report 2. para. IV-2-17),
      192-kbyte memory. Graphics monitor (color or B&W);
      two diskette drives or hard disk;   RS-232-C; HP 7470
      or HP 7475 (see "Automation Hardware and Retrofitting
      Techniques", Report 2. para. IV-11-2), option 001,
      graphics plotter (see "Automation Hardware and
      Retrofitting Techniques", Report 2. para. IV-11-1).

  e. <u>Compatible instruments</u>: Not applicable.

  f. <u>Features</u>:

      1. Spreadsheet workspace provides 2048 rows by 256
          columns. More than 50 functions performed,
          including mathematical, logical, financial,
          statistical, and database statistical functions.

      2. Graphics of up to six variables may be constructed
          from the spreadsheet or data base. Interfaces with
          more sophisticated plotting programs such as
          ChartMaster, FastGraphs, and Key Chart.

  g. <u>Software support</u>: Not specified.

  h. <u>Vendor support</u>: HELP screens and interactive tutorial
      diskette.

* Lotus Development Corporation 1985. Used with permission.

V-2-7.   **Product name and abstract:**   MATH/1000.   This electronic spreadsheet is a powerful analytical tool for most engineering, scientific, and business applications.   Models may be saved as disk files for later recall, and the results printed.

a.   **Application:**   Analysis.

b.   **Company:**   COMPROG, Inc.
                           P.O. Box 1459
                           Burbank, CA 91507
                           (Phone) (213) 848-1321

c.   **Pricing:**   Object code license: $595.00; manuals: $10.00

d.   **Hardware support:**   HP 1000 computer (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-2-9). Twenty-five pages of memory required.   Any HP 2000 series CRT terminal may be used with any of the RTE interface drivers.

e.   **Compatible instruments:**   Not applicable.

f.   **Features:**

   1.   Most common business and scientific functions are available, such as the transcendentals (e.g. trig functions), logs, exponents, net present value, internal rate of return, standard deviation, date arithmetic, look-up tables, and true matrix algebra.

   2.   Values may be displayed in eleven different formats.   Headings may be centered or left/right justified.

   3.   Models may hold up to 16k cells with as many as 510 rows or 78 columns.   Cells may be read/write protected.

   4.   Additional features include the ability to directly consolidate data from other files.

   5.   Job files (where frequently used common sequences may be executed from a file instead of entered manually).

   6.   The ability to selectively recalculate portions of a model.

7. Searches and sorts commands for both headings and values.

8. There is an optional direct access subroutine which allows an application program to read/write values directly to a MATH/1000 file ($150).

g. **Software support**: RTE-IV, RTE-VI, or RTE-A operating system.

h. **Vendor support**: Phone-in consulting, mail-in support, and program modification available. Ninety-day warranty, thirty-day acceptance period.

V-2-8. **Product name and abstract**: MSC/CASE. This program contains several thousand equations used in all phases of structural/mechanical engineering analysis and design activity. It is an interactive program, menu-driven, and organized in a modular format. No knowledge of computer operating systems or programming is necessary. The program provides full-color graphics.

a. **Application**: Analysis.

b. **Company**: The MacNeal-Schwendler Corporation
815 Colorado Blvd.
Los Angeles, CA 90041
(Phone) (213) 258-9111

c. **Pricing**: $895.00

d. **Hardware support**: A 16-bit personal computer, including IBM PC and compatibles (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-16 through 19, 3, and 4). 192-kbyte memory required.

e. **Compatible instruments**: Not applicable.

f. **Features**: Solves problems from the following categories:

1. Geometric and material properties, including properties of plane sections; properties of three-dimensional solids; neutral axis shift due to beam curvature; and material properties.

  2. Beams and columns, including: single span beams under transverse and axial loads or torsional twisting; multispan beams under transverse loading; curved beams; beams on elastic foundations of finite or infinite length; lateral buckling of beams; and buckling of columns.

  3. Rings, cables, arches, and frames, including: circular rings, cables, circular arches, single bay frames, and two-dimensional frames.

  4. Plates, shells, and pressure vessels, including: circular or rectangular plates, thin-walled cylindrical shells, thin-walled or thick-walled pressure vessels, and buckling of plates and shells.

  5. Natural frequencies, including: natural frequencies of discrete systems, natural frequencies of beams, and natural frequencies of plates.

  6. Stress calculations, conversion factors, and user-defined modules.

  7. Performs high resolution graphics.

g. **Software support:** MS DOS operating system.

h. **Vendor support:** Technical support for MSC/CASE is provided by DVSE, Inc. through a special telephone hotline. In addition, engineering consultation is available upon request to assist in solving complex problems and to develop customized user-defined modules.

MSC/CASE is a joint product of the MacNeal-Schwendler Corp. (MSC) and D.V. Schiavello Enterprises, Inc. (DVSE).

  V-2-9. **Product name and abstract:** Multiplan. This powerful spreadsheet program which is inexpensive and ⋯ learn.

  a. **Application:** Miscellaneous Spreadsheet.

MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS-1963-A

  b. <u>Company</u>:   Microsoft Corp.
           10700 Northrup Way, Box 97200
           Bellevue, WA   98009
           (Phone) (206) 828-8088

  c. <u>Pricing</u>: $195.00

  d. <u>Hardware support</u>: IBM PC computer (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-2-17), 128-kbyte, one disk drive.

  e. <u>Compatible instruments</u>: Not applicable.

  f. <u>Features</u>:

    <u>1</u>. Multiple windows

    <u>2</u>. Individual column width

    <u>3</u>. Sorting

    <u>4</u>. 255 x 63 cell matrix

    <u>5</u>. Limited database capability

  g. <u>Software support</u>: MS DOS and PC DOS 1.1 or later

  h. <u>Vendor support</u>: HELP menus

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  V-2-10. **Product name and abstract**: The Scientific Desk. The Scientific Desk contains a large library of FORTRAN subroutines for mathematical and statistical computation, complete "on-line" documentation, and problem solvers (PSEs). PSEs exist in elementary statistics, linear algebra, vector/matrix arithmetic, and eigenanalysis. Quadrature and approximation are optional.

  a. <u>Application</u>: Analysis.

b. **Company:** C. Abaci
208 St. Mary's Street
Raleigh, NC 27605
(Phone) (919) 832-4847

c. **Pricing:** Individual copy $420.00. Total site license: $840.00 per year.

d. **Hardware support:** IBM PC, PC/XT, and PC/AT (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-16 through 18).

e. **Compatible instruments:** Not applicable.

f. **Features:**

1. Library of functions and subroutines covering: arithmetic, error analysis, elementary and special functions of mathematical physics, linear algebra, interpolation, solution and nonlinear equations, optimization, differentiation and integration, differential equation, integral transforms, approximation and data fitting, statistics and probability, data handling, and service routines.

2. Problem solvers (PSEs) are self-contained systems which allow users to solve routine problems without the programming requirements. These cover eigensystem analysis, linear algebraic equations, matrix and vector arithmetic, statistical inference and estimations, and approximation and quadrature.

3. Built-in tutorials on topics such as linear algebra and linear programming.

g. **Software support:** Language: FORTRAN. Supports IBM Professional, IBM Version 2, Microsoft 3.2, and RM FORTRAN 5.

h. **Vendor support:** Complete on-line documentation and printed manual. Total site license includes maintenance and periodic upgrades.

V-2-11. **Product name and abstract:** TK! Solver. This is an equation processing program for engineering, science, finance, and education.

a. **Application:** Analysis.

b. **Company:**   Lotus Development Corp.
                          161 First Drive
                          Cambridge, MA 02142
                          (Phone) 617-253-9150

c. **Pricing:** $399.00

d. **Hardware support:** IBM-PC compatible, 128-kbyte (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-16 through 19, 3, and 4).

e. **Compatible instruments:** Not applicable.

f. **Features:**

    1. Supports mathematical models

    2. Solves single equations or sets of simultaneous equations

    3. Solves for lists of values

    4. Displays outputs in tables and plots

g. **Software support:** PC �archDOS, MS DOS.

h. **Vendor support:** Not specified.

Graphics

V-3-1. **Product name and abstract**: *CCSI-PLOT*. This software
package allows the convenient use of a dot matrix printer/plotter
as though it were a multipen, incremental X-Y pen plotter. It
provides the graphics tools to construct programs to produce bar
charts, contour plots, 3-D plots, engineering drawings, etc.

<u>a</u>. <u>Application</u>: Graphics.

<u>b</u>. <u>Company</u>:   Cerritos Computer Services, Inc.
                       4320 Atlantic Ave., Suite 1
                       Long Beach, CA 90807
                       (Phone) (213) 595-8607

<u>c</u>. <u>Pricing</u>: $495.00 for PCs; $1,500.00 - $1,950.00 for
     minis and mainframes.

<u>d</u>. <u>Hardware support</u>: This package is available for most
     micro, mini, and main-frame computers, including: IBM
     PC, PC/XT, PC/AT, Portable; DEC PDP-11; Perkin Elmer
     32-bit (see "Automation Hardware and Retrofitting
     Techniques", Report 2. paras. IV-2-16 through 18,
     respectively).

<u>e</u>. <u>Compatible instruments</u>: Printronix (see "Automation
     Hardware and Retrofitting Techniques", Report 2. para.
     IV-3-8), Trilog, Anadex, Epson (see "Automation
     Hardware and Retrofitting Techniques", Report 2. para.
     IV-3-6), Okidata, Adv. Color Tech., Qantex, IDS Prism,
     Dataproducts SPG, CIE terminals (see "Automation
     Hardware and Retrofitting Techniques", Report 2. para.
     IV-9-1), QMS Laser Grafix, DEC LA-100, LA-50, LN03, AMT
     Office printer, Santec S700, CalComp 960 plotter, and
     Tektronix 4662.

<u>f</u>. <u>Features</u>:

<u>1</u>. The graphics capabilities of the CCSI-PLOT include:
     points; vectors or line segments of specified
     length and angle; annotated axes with optional
     labels; shaded, cross-hatched, and completely
     filled areas; ten virtual "pens" that can assign
     unique dot patterns, line widths, and optionally,
     color; angle of rotation and size of text and axes;
     and erasure of previously plotted lines and areas.

2. The user can control the following: scaling of plotted information, independent offset and scale for data arrays, and form feed control for multipage plots.

g. **Software support**: PC DOS 2.0 or later, MS DOS, OS32MT, RT-11, or RSX-11M. Language: standard FORTRAN.

h. **Vendor support**: User's guide, installation instructions, demonstration programs, free telephone consultation services for 30 days after shipment.

V-3-2. **Product name and abstract**: CONTUR. This program produces smoothed and labeled contours from regularly spaced or scattered data. The program may be used for a variety of scientific and engineering applications such as hydrology, civil engineering, mining geology, chemistry, physics, and mathematics.

a. **Applications**: Analysis and graphics.

b. **Company**:   In-Situ, Inc.
    209 Grand Ave., P.O Box 1
    Laramie, WY 82070
    (Phone) (307) 742-8213

c. **Pricing**: $950.00

d. **Hardware support**: IBM PC, PC/XT, and compatibles (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-17 through 19, and 3, respectively).

e. **Compatible instruments**: HP 7470, 7475 (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-11-2), 7580, 7585,; Houston Instruments DMP 29, 42, 52 plotters and others.

f. **Features**:

1. A screen editor for entering instructions and contour data.

2. Creation of up to 50 frames (plots) during a single execution of the program. Frames may be stored for plotting at the user's convenience.

3. Up to six contour surfaces per frame.

4. Processing of up to 200 scattered data points or up to a 50 X 50 array of regular data points per contour surface.

5. Separate titles and labels for each frame.

6. Specification of minimum and maximum X and Y coordinates.

7. Labeling of the contour lines.

8. Specification of the lowest and the highest contour levels and the contour increment.

9. Optional dashed lines for all contour levels or just for contour levels less than zero.

10. Labeling of highs and lows.

11. Plotting of data values.

12. Provision of defaults for all options.

g. Software support: MS DOS operating system.

h. Vendor support: Not specified.

V-3-3. **Product name and abstract**: DISSPLA. This program provides a subroutine plotting language that can generate business or management charts, engineering and scientific graphs, reports, maps, contours, and three-dimensional designs. Output includes line graphs, bar charts, pie charts, text pages, and surface plots that may be drawn on a variety of media including paper, overhead transparencies, 35-mm slides, or CRT screens. Additional capabilities allow it to position several types of graphs on one page and to create legends and annotating bars.

a. Applications: Graphics.

b. Company: Integrated Software Systems Corporation.
10505 Sorrento Valley Blvd.
San Diego, CA 92121
(Phone) (619) 452-0170

c. **Pricing**: $9,500.00 - $61,000.00

d. **Hardware support**: 200 kbytes of memory required.

e. **Compatible instruments**: Device independent. Supports Tektronix 4105 (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-9-3).

f. **Features**: Not available.

g. **Software support**: FORTRAN compatible, FORTRAN source code.

h. **Vendor support**: Not specified.

V-3-4. **Product name and abstract**: **Key Chart**. This is a menu-driven presentation graphics package that is used in business, education, and scientific applications. Input may be loaded manually or from Lotus 1-2-3.

a. **Application**: Graphics.

b. **Company**:   Softkey Software Products, Inc.
                     18480 Decatur Rd.
                     Monte Sereno, CA 95030
                     (Phone) (416) 530-1931

c. **Pricing**: $375.00. Quantity discounts available.

d. **Hardware support**:   DEC Rainbow, IBM PC/XT (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-2-18), TI Pro, Wang PC, Zenith, or Apple II (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-2-2). Requires from 64- to 128-kbyte memory.

e. **Compatible instruments**:   Western Graphtec MP1000 Plotter; HP 7470, 7475 (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-11-2), 7550, Epson HI-80 (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-10-6), and others.

f. **Features**:

    1. Menu-driven with default values for every chart characteristic.

    2. Multiple preview ability.

    3. Plots bar charts, clustered bar charts, stacked bar charts, line charts, combined bar and line charts, multiple floating titles, pie charts, exploded pie charts, text plotting, organizational charts; full control of chart size and location on page.

g. **Software support**: Not specified.

h. **Vendor support**: Not specified.

V-3-5. **Product name and abstract**: PLOT-10; Interactive Graphics Library. This is a FORTRAN-callable interactive graphics library for the Tektronix 4010, 4100, and 4110 series computer display terminals and color copiers. It allows the user to perform graphic operations in a device-independent manner. Advanced options such as line smoothing, color panel support, graphics text composer, segments, and 3-D graphics may be added.

a. **Application**: Graphics.

b. **Company**:   Tektronix, Inc.
                      P.O. Box 500
                      Beaverton, OR 97077
                      (Phone) (503) 643-7768

c. **Pricing**: $4000.00 - $17,000.00

d. **Hardware support**:   Harris/VOS   compatible   (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-2-8), Perkin-Elmer series 3200 (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-2-21).

e. **Compatible instruments**: Tektronix 4010, 4100, and 4110 series (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-9-2 and 3).

f. **Features**: Not specified.

g. <u>Software support</u>: FORTRAN source code.

h. <u>Vendor support</u>: Software subscription service and technical assistance services available.

Courtesy of Tektronix, Inc.

V-3-6. <u>**Product name and abstract**</u>: Scientific Plotter-PC. Scientific Plotter-PC produces professional-looking graphs of scientific or business data. Graphs include semi-log and log-log scales, line plots, bar graphs, pie charts, and stock charts. All 128 standard ASCII character codes are available to print labels in four different orientations (at 90-degree angles).

a. <u>Application</u>: Graphics.

b. <u>Company</u>:   Interactive Microware, Inc.
                            P.O. Box 139
                            State College, PA 16804
                            (Phone) (814) 238-8294

c. <u>Pricing</u>: $95.00

d. <u>Hardware support</u>: 128-kbyte IBM PC (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-2-17), color/graphics board, one disk drive.

e. <u>Compatible instruments</u>: IBM, Epson (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-10-6), Okidata 82, C. Itoh 8510 (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-10-1), and IDS printers.

f. <u>Features</u>:

1. Full-screen resolution of 320 X 200 points.

2. Four different colors may be selected individually for symbols, lines, labels.

3. In high-resolution mode, prompting questions are printed on the left half of the screen while the graph is drawn on the right half of the screen. In the medium resolution mode, the full screen is used for drawing the graph.

4. All working files are saved on disk.

<u>5</u>. Axes may be auto-scaled by the program according to user's data.

<u>6</u>. Data may be entered as X,Y pairs, or as Y values at a constant X interval.

g. <u>Software support</u>: PC DOS 1.1, 2.0, or 2.1.

h. <u>Vendor support</u>: Instruction manual, demonstration plots on disk.

Communication

V-4-1. **Product name and abstract**: AdvanceLink HP45431A (or **HP45431E for IBM PC**). AdvanceLink is the data communications software that links an HP 150 touchscreen with other personal computers or an HP 3000 mainframe computer. An accessory product, Monitor/IBM PC, works with AdvanceLink to permit transfer of files between an HP touchscreen and an IBM PC.

a. **Application**: Communications.

b. **Company**:   Hewlett-Packard, Personal Computer Div.
                        11000 Wolfe Rd.
                        Cupertino, CA 95014
                        (Phone) (800) 538-8787

c. **Pricing**: $295.00 retail; $196.67 on GSA discount.

d. **Hardware support**: Standard HP 150 touchscreen PC or touchscreen MAX configuration (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-2-14). Optional printer.

e. **Compatible equipment**: Not applicable.

f. **Features**:

1. HP Touch permits execution of commands by just touching the screen.

2. ASCII or binary transfers means that information containing special control characters can be transmitted correctly.

3. A built-in software monitor permits the exchange of messages with another touchscreen personal computer or HP 3000.

4. Automatic logging to disk and printer makes transferring files as easy as touching the screen.

5. Error checking preserves the integrity of files during data transfer.

g. **Software support**: Suggested use of Monitor/IBM PC to ensure error checking.

h. **Vendor support**: Not specified.

V-4-2. **Product name and abstract:** Crosstalk XVI. This is a smart terminal program which captures ASCII and binary files. Includes auto dial and answer. Uses X-modem protocol.

a. **Application:** Communication.

b. **Company:** Microstuf Incorporated
1000 Holcomb Woods Pkwy. #440
Roswell, GA 30076
(Phone) (404) 998-3998

c. **Pricing:** $195.00

d. **Hardware support:** IBM PC and compatibles 96k, 1 disk drive (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-16 through 19, 3, and 4).

e. **Compatible instruments:** Not applicable.

f. **Features:**

1. Terminal emulation for IBM 3101, DEC VT100 and VT52, Televideo 910 and 920, and more.

2. Speeds to 9600 bps.

3. Forty programmable function keys for easy log on to remote systems.

g. **Software support:** MS DOS and PC DOS.

h. **Vendor support:** Not specified.

V-4-3. **Product name and abstract:** GPIB-PC DOS Software. The GPIB-PC software is a comprehensive package of programs which transforms the IBM or compatible personal computer into a GPIB controller with complete communications and bus management capability.

a. **Application:** Communications.

b. <u>Company</u>:   National Instruments
                       12109 Technology Blvd.
                       Austin, TX 78727
                       (Phone) (800) 531-5066

c. <u>Pricing</u>: $75.00

d. <u>Hardware support</u>:   IBM PC or compatible personal
   computers (see "Automation Hardware and Retrofitting
   Techniques", Report 2. paras. IV-2-16 through 19, 3,
   and 4).

e. <u>Compatible instruments</u>: GPIB-PC   (see   "Automation
   Hardware and Retrofitting Techniques", Report 2. para.
   IV-3-10) from National Instruments, or GPIB Adapter
   from IBM (see "Automation Hardware and Retrofitting
   Techniques", Report 2. para. IV-3-6).

f. <u>Features</u>:

   1. MS/PC DOS handler: installed as part of operating
      system; GPIB-PC appears as system resource;
      multiboard control; leaves maximum memory available
      for application.

   2. Extensive language support.

   3. High-level and primitive functions.

   4. Software and hardware diagnostics.

   5. Easy to use Configuration Program.

   6. Flexible Interactive Control Program.

   7. Comprehensive documentation and user support.

   8. Supports Tektronix standard codes and formats.

g. <u>Software support</u>:   Links to applications programs
   written in: BASIC, FORTRAN, C, Pascal, and Assembler.
   PC DOS or MS DOS version 2 or 3. National Instruments
   also markets ESP, Engineering Software Package, a set
   of 10 function calls supplied in source code adaptable
   to any operating system.

h. <u>Vendor support</u>: Comprehensive documentation and user
   support telephone service.

V-4-4.   **Product name and abstract**:   HP-IB Driver/Utility
for HP 150. This driver utility package provides for the control
and input/output (I/O) communications via the Hewlett-Packard 150
computer HP-IB (GP-IB, IEEE-488) port.   By providing ASCII I/O
through the HP 150 HP-IB port, many compatible devices such as
instruments, measurement systems, and other IEEE-488 devices may
be interfaced.

    a.   **Application**:   Communications.

    b.   **Company**:   Demand Systems, Inc.
                        6279 Variel Ave., Suite D
                        Woodland Hills, CA 91367
                        (Phone) (818) 710-8851

    c.   **Pricing**: $295.00, quantity discounts available.   A
        license agreement is required.

    d.   **Hardware support**:   This package requires a standard HP
        150   configuration   (see   "Automation   Hardware   and
        Retrofitting Techniques",   Report 2. para. IV-2-14).

    e.   **Compatible instruments**:   Not specified.

    f.   **Features**:   The software consists of executable binary
        files, and I/O routines that may be linked to the
        user's compiled BASIC, FORTRAN, or Pascal programs as
        an external LIBRARY.   Also, a binary memory image
        utility is provided which is "BLOADed" into the user's
        interpretive BASIC environments.   The following is a
        list of the available functions:

        1.   Initialization and control functions initialize,
            set up, or otherwise manipulate instruments
            either before or after data transfers.

        2.   Input and output functions are used to write data
            to or read data from the IEEE-488-compatible
            devices.

        3.   Polling functions provide for the polling, both
            serial and parallel, of devices on the IEEE-488
            bus.

        4.   Data transfer functions provide direct access to
            the data lines and some of the control lines of
            the IEEE-488 bus. These functions allow optimal
            handling of the binary data sent by some devices.

g. Software support: HP BASIC, FORTRAN, and Pascal.

h. Vendor support: The user's manual includes an example of BASIC program using input and output routines.

V-4-5. **Product name and abstract**: Monitor/IBM PC. This file transfer monitor/IBM PC is an accessory piece of software to AdvanceLink. It enables file transfer between an HP 150 touchscreen personal computer running AdvanceLink and an IBM PC. Both text (ASCII) and binary (program) files may be exchanged. The link between the touchscreen and the IBM PC may be established via modems or hardwired with an HP 13242H cable.

a. Application: Communications.

b. Company: Hewlett-Packard, Personal Computer Group
11000 Wolfe Road
Cupertino, CA 95014
(Phone) (800) 538-8787

c. Pricing: $95.00 retail; $63.33 on GSA discount.

d. Hardware support: Standard HP 150 touchscreen PC or touchscreen MAX configuration (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-2-14). An IBM PC with a 128-kbyte RAM (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-2-17) and an asynchronous communications adapter. HP 13242H cable optional. Printer optional.

e. Compatible equipment: Not applicable.

f. Features: Not specified.

g. Software support: AdvanceLink.

h. Vendor support: User's manual.

V-4-6. **Product name and abstract:** PC TALK III. This is a powerful but inexpensive program which allows communications and file transfers.

a. **Application**: Communications.

b. **Company**:   Freeware
                    The Headlands Press
                    P. O. Box 862
                    Tiburon, CA 94920
                    (Phone) (415) 435-0770

c. **Pricing**: $35.00

d. **Hardware support**: IBM PC Compatible (see Hardware report, paras. IV-2-16 through 19, 3, and 4), 64-kbyte, 1 disk drive.

e. **Compatible instruments**: Not applicable.

f. **Features**:

   1. Supports XON/XOF or Xmodem protocol

   2. Sixty entry dialing directory with autodial, autoanswer

   3. Forty programmable input strings

g. **Software support**: Languages: BASIC. MS DOS, PC DOS

h. **Vendor support**: Seventy pages of documentation on disk. Source code.

V-4-7. **Product name and abstract**: Portable-Desktop Link (PDL). The PDL is the necessary hardware and software on a desktop computer that enables the HP Portable to communicate with a desktop computer. The hardware provides a low-cost, high-speed communications link using the Hewlett-Packard interface loop HP-IL. The software is executed on the desktop computer. It enables the Portable to transfer information to or from a desktop and use peripherals on a desktop computer. HP part number HP 45643A supports communications with the HP 150 touchscreen desktop computer; HP part number HP 82973A supports communication with an IBM PC.

a. **Application**: Communications.

b. __Company__: Hewlett-Packard, Portable Computer Div.
1000 N.E. Circle Blvd.
Corvallis, OR 97330
(Phone) (800) 538-8787

c. __Pricing__: HP 45643A - $175.00 retail; $116.67 on GSA discount. HP 82973A - $150.00 retail; $125.00 on GSA discount.

d. __Hardware support__: HP Portable (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-2-10) and a desktop computer, either a HP 150 touchscreen or an IBM PC.

e. __Compatible equipment__: Not applicable.

f. __Features__:

1. Information may be transferred from the Portable to or from a disk that is attached to the desktop computer.

2. The Portable may use a printer which is attached to the desktop computer as if it were tied directly to the Portable.

3. The Portable is capable of using HP-IL peripherals such as the HP Thinkjet printer with the HP-IL interface.

4. The PDL is implemented on the HP 150 by the HP 45643A extended I/O accessory.

5. The PDL is implemented on the IBM PC/XT by the HP 82973A HP-IL interface card.

g. __Software support__: Not specified.

h. __Vendor support__: Not specified.

V-4-8. __Product name and abstract__: TRAVERSE. This is a software communications system providing networking utilities for networking topologies including both multipoint (i.e., LAN cable systems) and point-to-point (modem networks or simple RS-232-C links) constructs. Principal utilities provided include a multiple computer electronic mail system and a file transfer

to/from unattended computers (with error-free, computer-to-computer protocol); and for PC versions, remote access (for network users) and terminal emulation (for host execution).

a. **Application**: Communications.

b. **Company**:   Complexx Systems, Inc.
                          4930 Research Dr.
                          Huntsville, AL 35805
                          (Phone) (205) 830-4310

c. **Pricing**: MS DOS version: $195.00. UNIX V version: $795.00 plus media charge.

d. **Hardware support**: IBM PC (see "Automation Hardware and Retrofitting Techniques", Report 2. para. IV-2-17) or Unix-based computers with RS-232-C compatibility on each end.

e. **Compatible instruments**: Not applicable.

f. **Features**: Network communications may be implemented in a variety of computer hierarchies including: PC cluster, host/PC workstation, and host/host.

   1. Consists of a "core" for access, protocol, and network data base with user functions provided by communication utilities.

   2. Supports "star" or "ring" configuration. When many computers are linked with an addressable switching system such as XLAN, then any PC (or mini) may call any PC, or any printer or terminal attached to the switching system.

   3. Installation is a step-by-step query/response procedure with HELP screens and tutorials.

g. **Software support**: Either MS-DOS or UNIX-V operating systems.

h. **Vendor support**: Covered by a one-year limited warranty.

Miscellaneous

V-5-1. **Product name and abstract:** dBase III. This is a relational database manager with menus and prompts to assist novice users. Has a built-in program language which is used to develop applications using English-like commands.

    a. **Application:** Misc. Data Base.

    b. **Company:** Ashton Tate
        10150 W. Jefferson Boulevard
        Culver City, CA 90230
        (Phone) (213) 204-5570

    c. **Pricing:** $695.00

    d. **Hardware support:** IBM-PC or compatible, 256k memory, 2 disk drives (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-16 through 19, 3, and 4).

    e. **Compatible instruments:** Not applicable.

    f. **Features:**

        1. Over 2 billion records per data base

        2. 128 fields per record and 4 kbytes per record

        3. Ten database files can be used simultaneously

        4. Quick sorting and indexing

        5. Context-sensitive HELP

        6. Report and mailing label facilities

    g. **Software support:** DOS 2.0 or later.

    h. **Vendor support:** Not available.

V-5-2. **Product name and abstract:** Volkswriter Scientific. This page-oriented word processor is designed for scientific and engineering environments.

a. **Application:** Word Processing.

b. **Company:** Lifetree Software Inc.
411 Pacific Street
Monterey CA, 93940
(Phone) (408) 373-4718

c. **Pricing:** $495.00

d. **Hardware support:** IBM PC Compatible (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-16 through 19, 3, and 4), 256k, 2 disk drives.

e. **Compatible instruments:** Not applicable.

f. **Features:**

　1. Over 400 bit-mapped scientific and mathematical characters.

　2. Multiple type styles and sizes.

　3. User-definable fonts and scientific symbols.

　4. Definable and storable composite symbols and macros.

g. **Software support:** MS DOS and PC DOS.

h. **Vendor support:** On-screen tutorial, 9 HELP screens.

V-5-3. **Product name and abstract:** WORD. This powerful professional word processing program supports extensive formatting.

a. **Application:** Word processing.

b. **Company:** Microsoft Corp.
10700 Northrup Way, Box 97200
Bellevue, WA 98009
(Phone) (206) 828-8088

c. **Pricing:** $375.00

    d. <u>Hardware support</u>: IBM PC Compatible (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-16 through 19, 3, and 4), 256k, 2 disk drives.

    e. <u>Compatible instruments</u>: Not applicable.

    f. <u>Features</u>:

        1. Extensive formatting.

        2. Mouse support.

        3. Multiple windows.

        4. Glossary to insert commonly used phrases with simple codes.

        5. Undo command allows recovery from operator errors.

        6. 80,000 word spelling checker.

    g. <u>Software support</u>: PC DOS, MS-DOS.

    h. <u>Vendor support</u>: User hot line. On-screen tutorial.

V-5-4. <u>**Product name and abstract:**</u> **WORD STAR.** This family of word processing programs includes a table of contents generator, mail, list, merge, and spelling checker.

    a. <u>Application</u>: Word processing.

    b. <u>Company</u>:   MicroPro Intl. Corporation
                          33 San Pablo Ave.
                          San Rafael, CA 94903
                          (Phone) (415) 499-1200

    c. <u>Pricing</u>: $495.00

    d. <u>Hardware support</u>: IBM PC compatible (see "Automation Hardware and Retrofitting Techniques", Report 2. paras. IV-2-16 through 19, 3, and 4).

    e. <u>Compatible instruments</u>: Not applicable.

f. **Features**:

    1. Index generator.

    2. 65,000 word spelling checker.

    3. Block and column movement.

    4. Mailing list support.

g. **Software support**: PC DOS, MS DOS.

h. **Vendor support**: Not specified.

PART VI: SOFTWARE INDEX

BY

COMPUTER SYSTEM AND APPLICATION

Microcomputers

1. **DEC PDP-11/23 (or LSI-11) and DEC Rainbow.**

a. Data Acquisition.

   1. AIM, para. V-1-1.

   2. CHIPS, para. V-1-4.

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2. **HP 41C.**

a. Data Acquisition.

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3. **HP 75D.**

a. Communications.

   1. Portable-Desktop Link, para. V-4-7.

4. **HP 150.**

a. Data Acquisition.

   1. DARAD 150, para. V-1-7.

   2. Data Acquisition Software, para. V-1-10.

<u>b</u>. Analysis.

　　<u>1</u>. DynaSim, para. V-2-2.

　　<u>2</u>. GEOCONTOUR, para. V-2-3.

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　　<u>5</u>. Lotus 1-2-3, para. V-2-6.

　　<u>6</u>. MSC/CASE, para. V-2-8.

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<u>c</u>. Graphics.

　　<u>1</u>. CCSI-PLOT, para. V-3-1.

　　<u>2</u>. CONTUR, para. V-3-2.

　　<u>3</u>. Key Chart, para. V-3-4.

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　　<u>1</u>. Crosstalk XVI, para. V-4-2.

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　　<u>5</u>. TRAVERSE, para. V-4-8.

<u>e</u>. Miscellaneous.

　　<u>1</u>. dBase III, para. V-5-1.

　　<u>2</u>. Volkswriter Scientific, para. V-5-2.

　　<u>3</u>. WORD, para. V-5-3.

　　<u>4</u>. WORD STAR, para. V-5-4.

7. **Macintosh.**

<u>a</u>. Data Acquisition.

　　<u>1</u>. MACQUISITION/MACONTROL, para. V-1-24.

8.   **MACSYM 150.**

a.   Data Acquisition.

   1. DAIS, para. V-1-6.

Minicomputers

9. **CONCEPT/32.**

   <u>a</u>. Data Acquisition.

      <u>1</u>. PACE/32, para. V-1-32.

10. **DEC PDP-11/34, VAX.**

   <u>a</u>. Data Acquisition.

      <u>1</u>. AIM, para. V-1-2.

      <u>2</u>. IMPACT-I, para. V-1-20.

      <u>3</u>. PC/DBS, para. V-1-33.

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      <u>5</u>. RCS-7, para. V-1-36.

   <u>b</u>. Graphics.

      <u>1</u>. CCSI-PLOT, para. V-3-1.

11. **HARRIS H700.**

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12. **HP1000.**

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   <u>a</u>. Data Acquisition.

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<u>1</u>. CCSI-PLOT, para. V-3-1.

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PART VIII:
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Hart Scientific

> Q.E.D. DAC, para V-1-35.

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In-Situ, Inc.

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DISSPLA, para. V-3-3.

Interactive Arts

DynaSim, para. V-2-2.

Interactive Microware, Inc.

Scientific Plotter-PC, para. V-3-6.

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APPENDIX A: REQUIREMENTS DOCUMENT

REQUIREMENTS DOCUMENT

1. **Introduction**: Provide a description of the overall system and environment, and an overview of the functions to be performed.

2. **Functions**: Specify the functions to be performed by the software. Include items which are relevant to or dependent upon the hardware such as monitoring of 35 low-level input channels with a range of 100 mV and alarm generation for high and low levels.

3. **Performance**: Specify the performance requirements and define areas where tradeoffs or compromises may be made. For example: speed, number of channels, or accuracy may be areas of compromise.

4. **Accuracy**: Describe data accuracy requirements to be met including numerical, logical, and data transmission where appropriate.

5. **Timing**: Describe the timing requirements imposed on the program for all conditions necessary, such as,
   a. Response time.
   b. Update processing time.
   c. Data transfer and transmission time.
   d. Throughput and internal processing time.

6. **Flexibility**: Describe the capability for adapting the program to changes in requirements, such as:
   a. Modes of operation.
   b. Operating environment.

A1

<u>c</u>. Interfaces with other programs.

<u>d</u>. Accuracy, validation, and timing.

<u>e</u>. Planned changes or improvements.

Identify the components of the program that are designed to provide this flexibility.

7. **Equipment**: Identify the equipment required for the operation of the program. Include information on equipment required, such as:

<u>a</u>. Processor and size of internal storage.

<u>b</u>. Storage: on-line/off-line, media, form, and devices.

<u>c</u>. Data transmission devices.

8. **Support software**: Identify the support software and describe any test programs. If the operation of the program depends upon changes to support software, identify the nature and planned date of these changes.

9. **Interfaces**: Describe all interactions with the operator. Describe all interaction with other software, including sequence or procedure relationships and data interfaces.

10. **Storage**: Specify the storage requirements and any constraints and conditions, as follows:

<u>a</u>. <u>Internal</u>. Describe and illustrate the use of internal storage areas, including indexing and working areas. Briefly state the equipment and constraints and design considerations that affect the use of internal storage.

<u>b</u>. <u>Device</u>. List by device type all peripheral storage required. Briefly state any constraints imposed on storage requirements by each storage device. State requirements for permanent and temporary storage, including overlays.

<u>c</u>. <u>Off-line</u>. Describe the form, media, and storage requirements of all off-line storage.

A2

11. **Controls**: Describe the program controls, such as record counts, accumulated counts, and batch controls. Identify the sources of these controls.

12. **Operating procedures**: Describe the level of operator support available, both in technical ability and time allocations.

13. **Inputs**: Provide information about the characteristics of the inputs to the program and the source of these signals, such as:

a. Alarm devices.

b. Manual entries.

c. Calibration factors.

d. Data formats and types.

14. **Outputs**: Describe the required outputs including controls, alarms, displays, and data types.

15. **Storage requirements**: Describe the storage requirements for program data, method of access, and size limitation.

16. **Verification**: Describe the specific test conditions which will be used to verify that the software are in accordance with the requirements.

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